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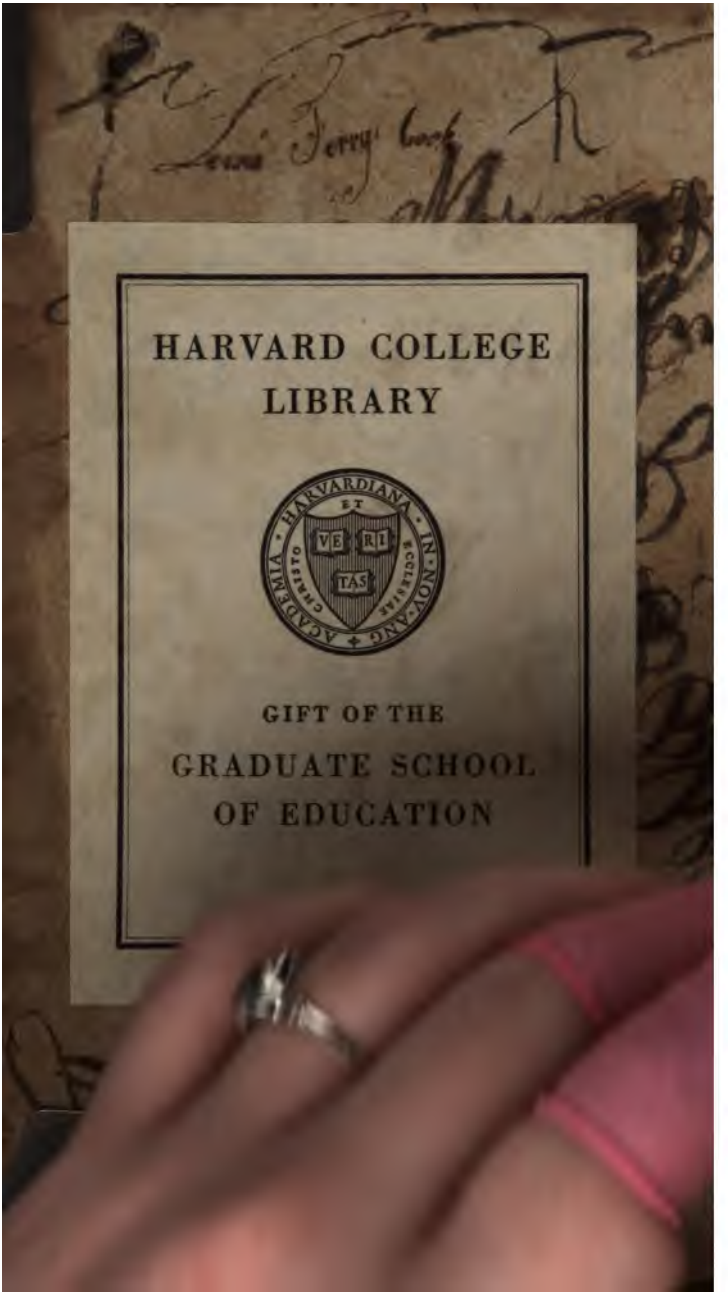
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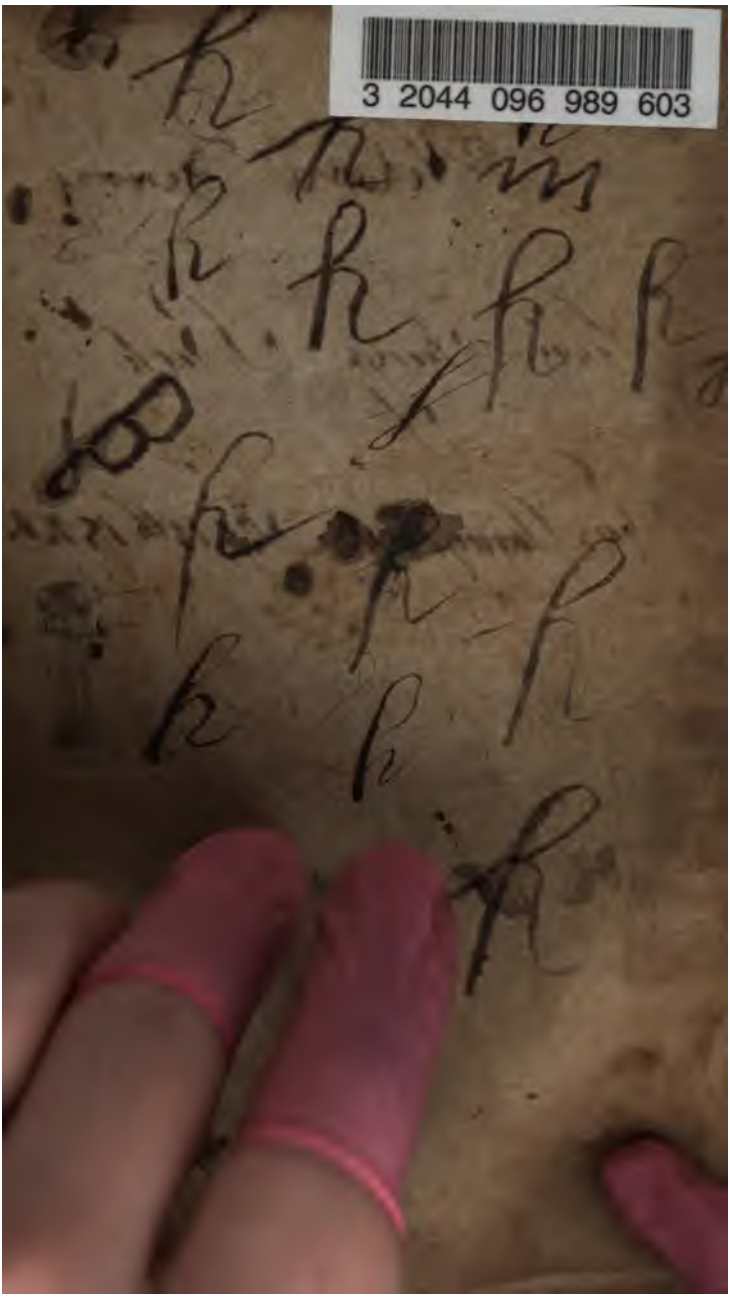

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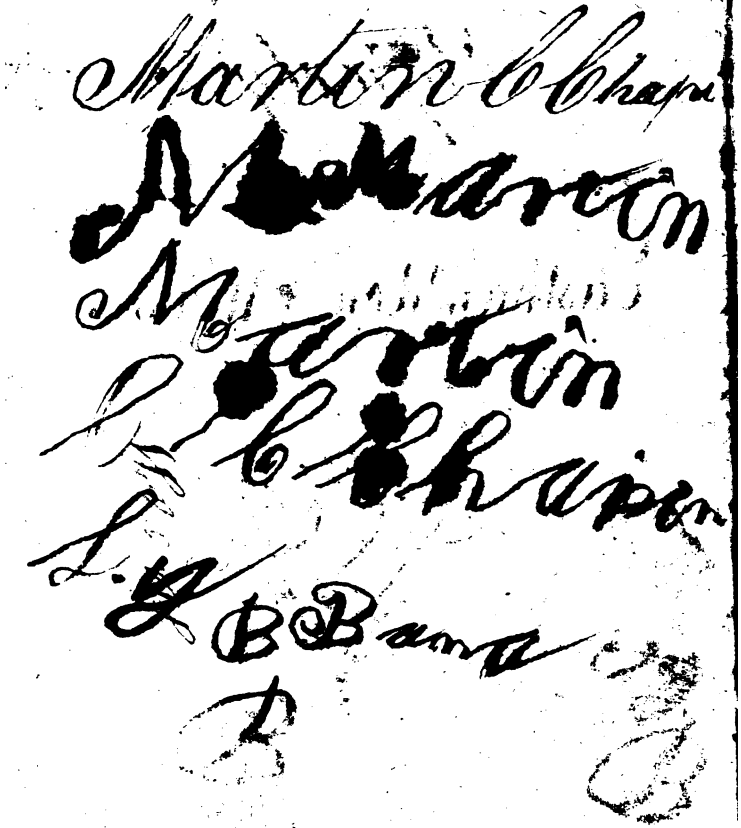

THE

SCHOLAR'S ARITHMETIC,

DESIGNED

FOR THE USE OF SCHOOLS,

IN THE

UNITED STATES.

BY JACOB WILLETTS.

SECOND EDITION.

POUGHKEEPSIE:

PUBLISHED BY PARACLETE POTTER.

P. & S. Potter, Printers.

1817.

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BE IT REMEMBERED, That on the twenty-fourth day of February, in the fortieth year of the Independence of the United States of America, Parselete Potter, of the said District, L. S. has deposited in this office the title of a book the right whereof he claims as proprietor, in the words following to wit:

"The Scholar's Arithmetic, for the use of schools in the United "States. By Jacob Willetts."

In conformity to the Act of the Congress of the United States entitled "An Act for the encouragement of Learning, by securing the Copies of Maps, Charts and Books to the authors and proprietors of such copies, during the times therein mentioned." And also to an Act, entitled, "an Act, supplementary to an Act entitled an Act for the encouragement of Learning, by securing the copies of Maps, Charts and Books to the authors and proprietors of such copies during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving and etching historical and other prints."

THERON RUDD,
Clerk of the Southern District of New-York.

PREFACE.

The Compiler of "AN EASY GRAMMAR OF GEOGRAPHY, *for the use of schools, upon Goldsmith's much approved plan,*" has been induced by the very flattering reception of that work, to undertake the compilation of an Arithmetic, which he has completed, and now offers to the same public who have already so liberally rewarded his humble efforts to serve them. So many different Arithmetics have been published, that the subject was, by many, supposed to be exhausted.—The compiler of the following work, however, has for sometime entertained the opinion that there was still room for improvement. He accordingly undertook this work, not so much however, with the view of acquiring credit as an original writer, as with the hope of being able to make a useful book. He has accordingly made free use of Dilworth, and most other authors, in whose works he found any thing that met his approbation.

In the arrangement of the Rules, as well as in the examples adapted to them, some improvement has been attempted; great care has also been taken to make the rules as concise and familiar as possible. A great variety of promiscuous examples have been introduced in the different stages of the work, which it is thought will contribute greatly to its utility. But the improvement upon which the compiler places his principal reliance, as giving his work a decided superiority over any other work of the kind, is the questions which he has introduced on the different rules. These questions, if properly used, cannot fail to be of important service in giving the learner a perfect understanding of the different rules. Indeed it is believed that no method hitherto devised, is so effectual for making the scholar thoroughly master of his studies, as that of requiring him to answer questions, embracing all the important particulars of what he has been learning. Experience has proved the utility of this method in the study of Geography, and the compiler of the following work, is sanguine in the belief, that it will not only be found equally useful in conducting learners to a knowledge of Arithmetic, but that it may be advantageously introduced into most other studies.

Great care has been taken through the whole work, so to adapt it to the mode of instruction and the course of business in the United States, as to make it particularly useful to American [illegible].

Fully sensible of the necessity of having an Arithmetic free of errors, the compiler has spared no pains in making his work as correct as possible. The proof sheets have been corrected with particular care, and every sum worked over with renewed attention, before the sheets were permitted to go to press. Notwithstanding this, however, a few, and it is believed, when the nature of the work is considered, they will be thought a very few, errors escaped observation. These have been corrected in an errata, at the end of the work. With these corrections, it is confidently believed the *Scholar's Arithmetic*, will in point of correctness of execution, bear a comparison with any similar work ever published in the United States.

With these remarks, the Compiler submits his work to the judgment of his fellow-citizens. All he presumes to ask for it, is, that no one will pass sentence upon it, until he has given it a patient and candid examination.

MECHANIC, 2d Mo. 29, 1816.

EXPLANATION OF CHARACTERS.

Signs.	Significations.
=	Equal; as 20s. = £1
+	more; as 6+2=8
—	less; as 8—2 =6
×	into, with, or multiplied by; as 6×2=12
÷	by (i. e. divided by) as 6÷2=3; or 2) 6 (3
: :: :	proportionably; as 2 : 4 : : 6 : 12
$\sqrt{}$ or $\sqrt{}$	square root; as $\sqrt{64}$=8
$\sqrt[3]{}$	cube root; as $\sqrt[3]{64}$=4
——	A Vinculum: denoting the several quantities, over which it is drawn, to be considered jointly as a single quantity.

Harvey Chapin's Book

ARITHMETIC.

Arithmetic is the art of computing by numbers.

It has five principal rules for its operation; viz. numeration, addition, subtraction, multiplication and division.

NUMERATION.

Numeration teaches to express numbers by figures, and consists of two parts, viz.

First, The right placing of figures.

Second, The true valuing of each figure in its proper place, as in the following

TABLES.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	
								1	One.
							2	1	Twenty-one.
						3	2	1	Three hundred and twenty-one.
					4	3	2	1	4 thousand 321
				5	4	3	2	1	54 thousand 321
			6	5	4	3	2	1	654 thousand 321
		7	6	5	4	3	2	1	7 million 654 thousand 321
	8	7	6	5	4	3	2	1	87 million 654 thousand 321
9	8	7	6	5	4	3	2	1	987 million 654 thousand 321

							1	0	Ten
						1	0	5	One hundred and five.
					1	0	0	0	1 Thousand.
				1	0	0	4	0	10 Thousand and 40
			1	0	0	0	0	1	100 Thousand and 1
		1	4	0	0	3	0	0	1 Million 400 thousand 300
	1	0	0	8	0	2	0	4	10 Million 80 thousand 204
	1	0	3	0	0	6	0	0	103 Million 6 thousand
	3	0	0	3	0	3	1	2	300 Million 303 thousand 12

Nine figures are sufficient to express any number in common practice, yet the following may be thought necessary.

Nonillions.	Octillions.	Septillions.	Sextillions.	Quintillions.
857324	162486	437916	374986	423147
Quadrillions.	**Trillions.**	**Billions.**	**Millions.**	**Units.**
248106	235421	261734	268149	623137

EXAMPLES.

Read the following numbers, or write them in words,

10, 14, 18, 20, 25, 31, 44, 63, 89, 99, 100, 102, 114, 145, 287, 405, 600, 756, 1000, 2010, 3436, 7034, 8004, 10325, 23463, 86703, 50043, 682413, 1324371, 1906312, 9849562, 41031638, 403092639, 244336577.

Write the following numbers in figures.

1. One thousand three hundred and fifteen. Ans. 1315.
2. Twenty.
3. Fifty six.
4. One hundred.
5. One hundred and six.
6. Two hundred and eighty three.
7. Seven hundred and forty six.
8. Nine hundred and nine.
9. Five thousand four hundred and eight.
10. Twenty six thousand eight hundred and twenty-four.
11. Five hundred and forty-five thousand four hundred and ninety.
12. Nine hundred and eight thousand.
13. Six hundred thousand.
14. Thirty thousand and three.
15. One million four hundred and seventy three thousand six hundred and eighty nine.
16. Fifteen millions five hundred and two.
17. Seventy three millions and ten.
18. Nine hundred and thirty two millions three hundred and forty thousand eight hundred and seventeen.
19. Two hundred millions six thousand and three.

SIMPLE ADDITION.

Addition teaches to collect several numbers into one.

The number formed by adding several numbers together, is called the *amount* or *sum*.

RULE.

1. Place the numbers or figures one under another, taking particular care to keep units under units, tens under tens, &c.

2 Begin at the right hand column and add upwards.

3. Set down the sum or amount, if it be less than 10.

4. If it should amount to 10 or more, then set down the right hand figure, and add the left to the next row of figures, and so proceed to the last column.

5. In the last column set down the whole of what it amounts to.

PROOF.

Perform the addition downward ;—or, add the top line to the sum of all the rest; and if right, the total will be equal to the first.

EXAMPLES.

4132	6548	46301
4311	7936	
6123	4695	413508
5121	9547	7404
		23809
19687	28726	
		491022
		444721
		49 022

2	3	21	46	54	87	57	410
1	2	32	21	36	41	21	324
3	4	20	93	62	42	18	361
1	5	14	24	50	43	35	345

432	345	487	4820	3026
174	234	435	5461	3074
384	567	568	3203	1020
265	433	432	4030	4005

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PROOF.

Add the remainder to the less number, and the sum, if right, will be equal to the greater.

EXAMPLES.

From	35678	561734	632074005
Take	12436	384261	4008075
Remainder	23242	177473	628065930
Proof.	35678	561734	632074005

4628453	65	153	845	352	462
1213212	49	121	284	23	171

74321	6473126	450413	3007421
36240	1048316	210841	134062

32016004	17359725	64271095	1204376
1834009	8423897	27357097	8514

PROMISCUOUS EXAMPLES

1. What is the difference between 540313 and 7953.
2. From 108632145 take 341.
3. Take one hundred and fifty six, from three hundred and twenty five.
4. Subtract fifteen thousand six hundred and four, from sixty thousand.
5. From one million take nine hundred and ninety nine thousand. Ans. 1000.
6. From one million, take one. Ans. 999999.
7. From nine hundred and eighty seven millions take nine hundred and eighty seven thousand. Ans. 986013000.

APPLICATION.

1. *Charles* has 47 marbles, and John has 30, how many has *Charles more than John?* Ans. 17.

2. William is seventeen years old, and Henry is nine, how much older is William than Henry? Ans. 8.

3. Edwin has two baskets filled with apples, one has got one hundred and two in it, the other has got but forty three; how many more are there in the larger than in the smaller basket? Ans. 59.

4. A person had in the bank $10002 and takes out 1404; how many has he left? Ans. $8598.

5. A vintner bought 30 casks of Brandy, containing 3127 gallons, and sold 18 casks containing 1871 gallons, how many casks and gallons had he left? Ans. 12 casks, and 1256 gals.

6. How many years have elapsed since the discovery of America by Christopher Columbus in 1492, to the present year 1816. Ans. 324 years.

7. I have borrowed of my friend for 12 months $2345, after 5 months I pay him $928; how many months will it be before the remainder is due, and how many dollars have I then got to pay him? Ans. 7 months. $1417.

SIMPLE MULTIPLICATION.

Simple Multiplication is a short way of performing addition, and consists of the following terms:

Multiplicand, or number to be multiplied.

Multiplier, or number by which you multiply.

Product, or number produced by multiplying the other two together.

Note. Both multiplier and multiplicand are in general called *factors*.

☞ The scholar should commit the following table to memory before he proceeds further.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

CASE 1.

When the multiplier is not more than twelve.

RULE.

1. Set the multiplier under the units place of the multiplicand;

2. Multiply each figure in the multiplicand by the multiplier:

3. If the product do not exceed 9 set it down:

4. But if it exceed 9, set down its right hand figure and add its left hand figure or figures to the product of the next, and so proceed through the sum;

5. Set down all of the last product.

PROOF.

Multiply the multiplier by the Multiplicand: or

Proof by excess of nines—cast the nines out of the multiplicand, multiplier and product, and set the excess of each opposite their respective terms.

Then multiply the excess of nines in the multiplicand by the excess in the multiplier, rejecting the nines, and if the surplus is the same as the surplus of the product, the sum is right.

EXAMPLES.

Multiplicand.	2143213242	267485	67004839
Multiplier.	2	2	3
Product	4286426484	534870	201014517

20341232143	2674	3871	5402
2	2	3	4
57086534	57086534	75136528	
2	3	4	
64132579	83174268	41379462	
5	6	7	
74136982	80736014	9761436	
8	9	10	
47140651		273406152	
11		12	

CASE 2.

When the multiplier exceeds 12, or consists of several figures.

RULE.

1. Place the multiplier under the multiplicand with units under units, tens under tens &c.

2. Multiply by each significant figure* in the multiplier separately, placing the first figure in each product exactly under its multiplier.

3. Then add the several products together in the same order as they stand, and their sum will be the total product.

EXAMPLES.

			Proof by excesses of nines
Multiplicand	365	46834	7
Multiplier	47	406	1 } -7
	2555	281004	
	1460	187336	
Product	17155	19014604	7

Multiplicand	7646	7684	5231
Multiplier	32	67	145
Product	244672	514828	758495

6	Multiply 43486	by 6004	Ans.		261089944
7	- - - 527527	by 285	-	-	150345195
8	- - 269181	by 4629	-	-	1246058849
9	- - 25203	by 4025	-	-	101442075
10	- - 261986	by 7638	-	-	2001049068
11	- - 380092	by 8075	-	-	3069242900
12	- - 527535	by 15728	-	-	8297070480
13	- - 38015732	400700065	-		15232906283422580

CASE. 3.

When there are cyphers on the right hand of either or both of the factors.

RULE.

Neglect the cyphers and place the significant figures under one another and multiply by them only; and to the right hand of the product place as many cyphers as were omitted in both the factors.

*The significant figures are 1 2 3 4 5 6 7 8 9. the 0 is called an *insignificant figure*, because of no value when it stands alone.

EXAMPLES.

1	Multiply	21200	by	70	Ans. 1484000
2		7684000	by	7800	- 59935200000
3		35926000	by	3040	- 109215040000
4		360000	by	120000	- 43200000000
5		749643	by	6950000	- 5210018850000

CASE 4.

When the multiplier is the exact product of any two figures in the multiplication table.

RULE.

Multiply by one of those figures and that product by the other, the last product will be the answer.

EXAMPLES.

Multiply 41364 by 35 — 5 times 7 make 35

7

289548 Product of 7

5

1447740 Product of 35

2	Multiply	764131	by	48	Ans.	36678288
3	Multiply	342516	by	56	Ans.	19180896
4	Multiply	91738	by	81	Ans.	7430778
5	Multiply	4976	by	108	Ans.	537408
6	Multiply	3742	by	144	Ans.	538848

APPLICATION.

1. Henry has 132 chesnuts, and Anthony has 4 times as many. How many has Anthony? Ans 528.

2. Suppose 40 men were concerned in the payment of a debt, and each man paid 2564*l*. How much was the debt? Ans. 102560*l*.

3. If 9876 be multiplied by six thousand seven hundred and eighty-nine, what is the product? Ans. 67048164.

4. Bought 342 bales of linen, in each bale 56 pieces, and in each piece 25 yards; how many pieces and yards were therein? Ans. 19152 pieces, 478800 yards.

5. Admit an orchard consisting of 128 trees one way, 100

the other, and 1007 apples on each tree; how many trees and apples are in said orchard ?

Ans. 13734 trees, 13830138 apples.

6. Supposing that a certain state contains 52 counties, each county 42 townships, each township 246 houses, and each house 10 persons; how many townships, houses, and persons are in the state.

Ans. 2184 townships, 537264 houses, 5372640 persons.

SIMPLE DIVISION.

Division is a short way of performing several subtractions; and teaches to find how many times one whole number is contained in another; and also what remains.

There are four principal parts belonging to Division.

1. The *Dividend*, or number given to be divided.
2. The *Divisor*, or number given to divide by.
3. The *Qoutient*, or answer, is the number of times the divisor is contained in the dividend.
4. The *Remainder* is what is left after the work is finished, and is always less than the divisor, and of the same name as the dividend.

There are two kinds of Simple Division, viz. Short and Long Division.

SHORT DIVISION.

Short Division is when the divisor does not exceed 12.

RULE.

1. Place the divisor to the left hand of the dividend.
2. Then see how often the divisor is contained in the first figure or figures of the dividend, under which set the result.
3. If any remain, conceive it to be prefixed to the next figure, see how often the divisor is contained therein, and so proceed.

PROOF.

Multiply the quotient by the divisor, adding in the remainder, if any, and the product will be the dividend.

EXAMPLES.

	Dividend		
Divisor	2)7346286	3)5112896	2)864826482
Quotient	3673143	1704298 : 2 Rem.	
	2	3	2)72510765
Proof	7346286	5112896	

3)7210472 4)62104163 5)97036120

6)74830956 7)91430682 8)37846210

9)73004881 10)47390172 11)41036294

12)64381259 7)59436828 8)73426284

LONG DIVISION.

Long Division is that wherein the Divisor exceeds 12.

RULE.

1. Place the dividend and the divisor as in Short Division.

2. Consider how many times the divisor is contained in as many figures of the dividend as are necessary, and place that number on the right hand of the dividend for the first figure in the quotient.

3. Multiply the divisor by this number, and place the product under the left hand figures of the dividend.

4. Subtract this product from the dividend, and call the difference the first remainder, which must be less than the divisor.

5. Bring down the next figure in the dividend, and place it to the right hand of the remainder

6. Consider how many times the divisor is contained in this number, place the figure in the quotient, and proceed as before, till all the figures in the dividend are brought down.

PROOF.

By Multiplication as in Short Division, or by adding the remainder and each bottom line in one sum.

EXAMPLES.

Dividend	Quotient.
Divisor 24)634978	(26457
48	
154	
144	
109	
96	
137	
120	
178	
168	
10 Remainder	
634978 Proof by addition	

Dividend	Quotient.
320(12864016081(40200050	
1280	
640	
640	
1608	
1600	
81	

3	Divide 742859226 by 51	Ans. 14565869	Rem. 7
4	153598 by 29	5296	14
5	9870 by 42	235	0
6	253622 by 422	601	0
7	4633 by 41		0
8	92587 by 72		67
9	40231 by 75		31
10	137896254 by 72		67
11	46242 by 52		126
12	13699840 by 342		4
13	863256 by 736		664
14	1893312 by 2076		0

15	46447786 by 1234	26
16	4586841 by 3467	0
17	761858465 by 8465	0
18	761858465 by 90001	0
19	119184698 by 38473	33812

CASE 2.

1. When there are cyphers at the right hand of the divisor they must be cut off; also cut off the same number of figures from the dividend, and then proceed as before.

2. But the figures which were cut off from the dividend must be placed at the right hand of the remainder.

EXAMPLES.

1. Divide 146340 by 5400 Ans. 27 Rem. 540

54)00)1463[40(27
108

383
378

540

2	Divide	76173	by 320	Ans. 238	Rem. 13
3		3794326	by 6500		4826
4		421407256	by 49000		7256
5		4673625	by 21400		8425
6		7649580	by 100		80
7		654347230	by 901000		221230
8		763753	by 1000		753

CASE 3.

When the divisor is such a number, that any two figures in the Multiplication table, being multiplied together will produce it, divide the given dividend by one of those figures, the quotient thence arising by the other, and the last quotient will be the answer.

Note. The total remainder is found by multiplying the last remainder by the first divisor, and adding in the first remainder.

Local

EXAMPLES.

1. Divide 46508974 by 96 Facit 484468 Rem. 46

8)46508974

12)5813621 : 6 first Remainder.

484468 : 5 last Remainder.

8 times 12are 96 8

40
6

46

2	Divide 20208 by	48	Ans. 421	Rem.
3	467412 by	24	19475	12
4	937387 by	54	17359	1
5	145266 by	108	1345	6
6	1575360 by	144	10940	0

SUPPLEMENT TO MULTIPLICATION.

To multiply by a mixt number; that is a whole number joined with a fraction as $4\frac{1}{2}$ $5\frac{3}{4}$ $6\frac{1}{4}$, &c.

RULE.

Multiply by the whole number, and take $\frac{1}{4}$ $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{7}$, &c. of the multiplicand, and add it to the product;—Or multiply the upper number of the fraction, and divide its product by the under one, and the result will be the value of the fraction.

EXAMPLES.

1 Multiply 26 by $5\frac{1}{2}$

2)26

$5\frac{1}{2}$

130

13 $\frac{1}{2}$ of 26

143 Ans.

2 Multiply 48 by $14\frac{3}{4}$

2)48

14

192

48

2) 24 $\frac{1}{2}$ of 48

12 $\frac{1}{4}$ of 48 or

$\frac{1}{3}$ of 24

708

Or,

48

14

192

48

36 $\frac{3}{4}$

708

48

3

4)144

36

3	Multiply 16 by $6\frac{1}{2}$	Ans.	104
4	204 by $18\frac{3}{5}$		3774
5	8 by $4\frac{3}{4}$		38
6	126 by $8\frac{1}{3}$		$1033\frac{1}{3}$
7	58 by $40\frac{1}{2}$		2349
8	824 by $6\frac{3}{4}$		5562
9	36 by $\frac{3}{4}$		27

APPLICATION TO DIVISION.

1 How many 4's are there in 32? Ans. 80.

2 A man intending to go a journey of 3264 miles, would wish to perform it in 136 days, how many miles must he travel each day? Ans. 24 miles.

3 If a man's board cost him 72 shillings for a month, or 4 weeks, how much does he pay for each week? Ans. 18s.

4 Several boys went to gather nuts, and collected 4275, which when shared among them, each had 855; how many boys were in company? Ans. 5 boys.

5 A farm of 375 acres is let for 1125 dollars, how much does it pay per acre. Ans. 3 dollars.

6 Supposing a man's income to be 2555 dollars a year; how much is that per day, there being 365 days in a year? Ans. 7 dollars.

Questions to exercise in Addition, Subtraction, Multiplication and Division.

1. If I add 167, 894 and 447, and divide their amount by 12, what number will result. Ans. 84.

2. Deborah bought 24 peaches: she kept 14 of them herself and divided the rest between her two little sisters, how many had each? Ans. 5.

3. Admitting a man has a farm containing 200 acres, which is divided into plough, pasture, meadow, and wood land, he has 50 acres of wood, 25 of meadow, 60 of pasture; how many acres were there left for plough land. Ans. 65.

4. Suppose 2072 apple trees be planted in 14 rows; how many will there be in each row, and how many bushels of apples will the orchard bear, admitting each tree to have 12 bushels on it. Ans. 148 trees and 24864 bushels.

5. A man at his decease, left property, amounting to 12426*l*. He directed in his will that 1000*l*. should be given to his niece; and that the remainder of the property should be divided, equally, between his two nephews What is the share of each nephew? Ans. 5713*l*.

6. To find how many dollars are contained in any number of pounds, we multiply the pounds by $2\frac{1}{5}$. How many dollars are there in 846*l*. Ans. $2115

7. There are 16 bags of coffee, weighing each 120 pounds, and 8 bags weighing each 343 pounds. What is the weight of the whole ? *Ans.* 4664

QUESTIONS IN NUMERATION.

What is Arithmetic ?

How many principal rules are there in Arithmetic ?

What are they called ?

What does numeration teach ?

What does it consist of ?

When several figures are set down together, which is the units, which are the tens, which the hundreds, &c.

QUESTIONS IN ADDITION.

What does addition teach ?

What is the amount or sum ?

How should we place figures to be added, and wherein is particular care necessary ?

Where do we begin to add a sum ?

When the sum or amount of each column does not exceed nine what must be done with it ?

But if the sum or amount is more than nine, which of the figures is to be set down, and what is to be done with the other ?

What is to be observed in setting down the sum of the last column ?

How is addition proved ?

QUESTIONS IN SUBTRACTION.

What does simple subtraction teach ?

In subtraction what is the greater number, the less one, and the difference called ?

How are numbers placed to be subtracted ?

Where do we begin to subtract, and how is it performed ?

When the lower figure is larger than the one above, what is then to be done ?

When 10 is thus added to the upper figure what do we do ?

How is subtraction proved ?

QUESTIONS IN SIMPLE MULTIPLICATION.

What is simple multiplication ?
What are the names of the terms in simple multiplication ?
Which term is the multiplier ?
Which is the multiplicand ?
What is the product ?
What are the multiplier and multiplicand generally called ?
Where must the multiplier be set under the multiplicand ?
After placing the multiplier in its proper place, what is done with it ?
When the product does not exceed 9, what should be done with it ?
But if the product exceed 9, which figure must be set down, and what should be done with the other ?
What must be done with the last product ?
How is multiplication used ?
When the multiplier exceeds 12, or consists of several figures, how must it be placed ?
What must be done with each figure of the multiplier, and how must the product of each be placed ?
How is the total product found ?
When there are cyphers on the right hand of either or both the factors, what must be done with them ?
When the multiplier is the exact product of two figures in the multiplication table, how should we proceed to obtain the answer ?

QUESTIONS IN SIMPLE DIVISION.

What is division ?
What does division teach ?
How many principal parts are there belonging to division, and what are they called ?
Which is the dividend ?
Which is the divisor ?
Which the quotient ?
Which is the remainder ?
What is always observed respecting the remainder ?
How many kinds of simple division are there ?
What is short division ?

How are the divisor and dividend to be placed ?

What is the first step taken in short division ?

If there be any remainder what is to be done with it ?

How is division proved ?

What is long division ?

Having placed the divisor and dividend in their proper places, what is first to be considered ?

What is done with the figure or number that is placed in the quotient ?

What is done with the product found by multiplying the quotient and divisor together ?

What must be prefixed to the remainder ?

After having brought down a figure, and placed it in its proper place, what is then done ?

How is long division proved ?

When there are cyphers at the right hand of the divisor, how is the operation generally performed ?

What is done with those figures which are cut off in the dividend ?

When the divisor is the product of any two figures in the multiplication table, how do we proceed ?

When we divide thus and there are remainders, how is the total remainder found ?

How do you multiply by a mixt number, that is, a whole number joined with a fraction ?

FEDERAL MONEY.

The denominations of Federal Money are, Eagle, Dollar, Dime, Cent and Mill.

10 mills (m) make	1 cent.
10 cents	1 dime.
10 dimes (or 100 cts.)	1 dollar, Dol. $
10 dollars	1 Eagle.

The relative value of these denominations are precisely the same as those of units, tens, hundreds, &c. For this reason, Federal Money is added, subtracted, multiplied, and divided by the same rules that are given for Simple Addition, Subtraction, Multiplication, and Division.

It is not customary in reading sums in Federal Money to mention eagles or dimes, as the following table will show.

Thousands of dollars	Hundreds of dollars	Eagles or tens of dollars	Dollars	Dimes or tens of cents	Cents	Mills	
					2	3	2 cents 3 mills
			1	2	3	0	1 dollar 23 cents
		2	4	1	0	5	24 dollars 10 cents 5 mills
	3	6	0	0	8	1	360 dollars 8 cents 1 mill
	6	0	7	2	4	8	607 dollars 24 cents 8 mills
6	0	2	1	4	3	1	6021 dollars 43 cents 1 mill
5	7	8	4	0	0	5	5784 dollars 5 mills

ADDITION OF FEDERAL MONEY.

RULE.

1 Place the sums one under another, with dollars under dollars, cents under cents, and mills under mills.

2 Then add them up, and carry in the same manner as in simple addition, observing to keep the mills, cents and dollars separated from each other, by placing a point between them.

PROOF.

As in simple addition.

EXAMPLES.

Dols.	cts.	m.
349	40	4
436	39	
378	94	5
169	06	
7344	76	9
$8678	56	8

D.	cts.	m.
	18	5
4	12	5
89	06	2
2140	00	
4000	50	3
6238	87	5

D.	cts.
21	14
56	10
65	75
53	40
84	84

D.	cts.	m.
74	38	6
25	50	2
21	40	5
216	52	4
515	68	5

D.	cts.	m.
824	30	5
36	02	1
413	00	2
764	92	8
174	32	5

D.	cts.	m.
	5	0
	26	4
1	74	8
21	74	3
86	49	5

7. Add the following sums; 326 dollars; 184 dollars; 1000 dollars; and 83 dollars.

8. Add $45 30 cents: $20 12 cents; $3000 1 cent; and $600 34 cents.

9. Add 4 cents; 72 cents; 83 cents; 16 cents; and 10 cents.

10. Add $1 12 cents 5 mills; 18 cents 7 mills; $2 36 cents, and $11 8 cents 3 mills.

11. Add $342 83 cents 5 mills; 86 cents; $143; $1 5 mills, $101 6 cents. Ans. $588 76cts. 0m.

APPLICATION.

12. Bought a hat for $5; a vest for 3 dollars 50 cents; a coat for 15 dollars 50 cents; a pair of boots for 8 dollars 50 cents. What is the cost of the whole? Ans. $32 50 cents.

13. Admit a bond of 3420 dollars 64 cents is due me, and the interest on it is 100 dollars 49 cents, what is the amount? Ans. $3521 13 cts.

14. Bought a Spelling Book for 25 cents, a Dictionary for $1 12 cents 5 mills, an English Reader for 75 cents, a slate 31 cents, a pencil 1 cent, and a penknife 50 cents; what do they all amount to? Ans. $2 94cts. 5m.

15. Suppose I am indebted

To A twenty seven dollars thirty cents
B sixty dollars, fifty cents, and nine mills
C fifty dollars, ninety eight cents
D one hundred dollars, seven mills
E seven dollars, four cents and eight mills
F thirty dollars, seventy five cents
G forty eight dollars, twenty cents
H seventy three dollars, twenty seven cents:

How much is the amount of my debts? Ans. $398 6cts. 4m.

SUBTRACTION OF FEDERAL MONEY.

RULE

Place the less sum under the greater, with dollars under dollars, cents under cents, and mills under mills, and then subtract as in whole numbers.

Note. The dollars, cents and mills must be separated by dots.

EXAMPLES.

Dol. cts.	Dol. cts m.	Dol. cts m.
46, 74	43, 21, 5	764.
13, 89	1, 00 0	8, 24, 5
32, 85	42, 21, 5	755, 75, 5

D. c. m.	D. c. m.	D. c. m.
694, 34, 2	123, 04, 5	5, 34, 8
360, 70, 4	86, 70, 6	1, 54, 2

D c. m.	D. c.	D. c. m.
66, 41, 3	50, 60	100, 0 0
13, 14, 2	1,	1

10 Subtract $326 from $1000.
11 Subtract $9 9cts. from $125. Ans. $115 91cts.
12 From $127 1ct. take $41 10cts. Ans. $85 91cts.
13 From forty one dollars eight cents take one dollar nine cents. Ans. $39 99cts.
14 From $100 take 1 mill. Ans. $99 99cts. 9m.
15 From $20 take 20 cents. Ans. $19 80cts.

APPLICATION.

1. A boy borrowed 2 dollars 6cts. and returned 50 cents, how much is he in debt? Ans. $1 56cts.

2. A merchant bought a quantity of coffee, for which he paid $426. He afterwards sold it for $526 37 cts. 5 mills: How much did he make by the sale? Ans. $100 37cts. 5m.

3. A miller bought 356 bushels of wheat for $700, and sold 200 bushels for $380 56cts. How many bushels has he on hand, and what does it stand him in?
Ans. 156 bush. $319 44cts.

4. Sent $4700 to the bank, and having drawn out $1002, how much still remains in? Ans. 3698.

MULTIPLICATION OF FEDERAL MONEY.

RULE

Set the multiplier under the sum to be multiplied as in Simple Multiplication, and proceed in the same manner, carefully observing to distinguish by dots the mills, cents and dollars.

Proof; as in Simple Multiplication.

EXAMPLES.

D. cts.	D. cts. m.	D. cts. m.
14, 25	324, 21, 5	12, 37, 5
5	6	135
71, 25	1945, 29, 0	61875
		37125
		12375
		1670, 62, 5

Dols. cts.	Dols. cts. m.	Dols. cts.	Dols. cts. m.
342 : 12	425 : 13 : 4	203 : 41	87 : 26 : 4
3	5	7	2 8

		Dols. cts. m.			Dols. cts. m.
8	Multiply	5000	by	6 Product	30000 : 00
9		42 : 28	by	3	126 : 84
10		136 : 00 : 5	by	8	1088 : 04
11		29 : 50	by	12	354
12		300 : 30 : 3	by	14	4204 : 24 : 2
13		41 : 51 : 8	by	76	3155 : 36 : 8
14		365 : 14 : 4	by	123	44912 : 71 : 2
15		29 : 8 : 3	by	138	4013 : 45 : 4

APPLICATION.

1. How much will 14 dozen eggs come to at 12½ cents the dozen? Ans. $1 75 cents.

2. How much will 5 bushels of potatoes come to at 50 cents a bushel? Ans. $2 50 cents.

3. What will 8 cords of wood come to at $4 50 cents a cord? Ans. $36

4. What cost 94 bushels oats at 33 cents per bushel? Ans. $31 2 cents.

5. Bought 37 oxen for $52 each: what do they come to? Ans. $1924.

6. What do 60 firkins of lard come to at $7 14 cents per firkin? Ans. $428 40 cts.

7. What cost a farm containing 125 acres at $30 50 cents an acre? Ans. $4562 50 cts.

8. Find the amount of the following bill.

Poughkeepsie, 1st Mo. (Jan.) 1st, 1816.

Benjamin Paywell

Bo't of Timothy Merchant.

		$ cents
28 lb of green tea,	at	2 15 per. lb.
41 lb of coffee,	at	0 21
34 lb of loaf sugar,	at	0 19
13 cwt. of Malaga raisins,	at	7 31 per cwt.
35 firkins butter,	at	7 14 per fir.
27 pair of worsted hose,	at	1 04 per pair

FEDERAL MONEY.

		$ cts.
bushels of oats,	at	0 33 per bush.
pair of men's shoes,	at	1 12 per pair.

Amount, $511 78cts.
Received payment in full.
Timothy Merchant.

DIVISION OF FEDERAL MONEY.

RULE.

. If the sum to be divided, consist of dollars, cents and ls, divide as in Simple Division.

. But if there should be only dollars, then set two cyphers he place of cents, and if you wish mills, then set another ther for mills.

. If, when the sum is divided, there were cents and mills he dividend, then point off the first figure on the right hand the quotient for mills, the next two for cents, and all the aining ones, if any, will be dollars.

PROOF.

As in Simple Division.

EXAMPLES.

ol. cts.	Dol. cts.	Dol. cts. Dol.cts.m.
63,64,0	4)56,34,1	49)6434,49(131,31,6
		49
51,51,5-5	14,08,5-1	
		153
		147
ol.cts.m.	Dol.cts.m.	
42,81,4	8)37,38,4	64
		49
		154
ol.cts.m.	Dol.cts m.	147
32,45,3	12)87,04,3	
		79
		49
		300
		294

8. Divide $56 43 cts. by 7 Ans. $8 6cts. 1m.
9. Divide $1784 64 cts. 16
10. Divide $365 24 cts. 2 m. 28
11. Divide $186 30 cts. 4 m. 38
12. Divide $53 49 cts. 9 m. 138
13. Divide $156 50 cts. 2 m. 473

APPLICATION.

1. Divide $52 24 cents between 24 persons.
Ans. $2 17cts. ×

2. Bought 40 bushels of wheat for $72 34 cts. how much is that per bushel. Ans. $1 80cts. 8m. ×

3. If a man bought a load of hay for $6 that weighed 15 hundred weight, what was it per cwt. Ans. 40cts.

4. Paid $58 75cts. for 235 yards of muslin. What was it per yard? Ans. 25cts.

5. Sold 144 yards of homespun cloth for $90; how much is that per yard? Ans. 62cts. 5m.

PROMISCUOUS EXAMPLES IN THE FOREGOING RULES.

Of Federal Money.

1 If I add the following sums, viz. $583 18cts. $8431 6cts. 4m. $20 14cts. and subtract from their amount $1312 14cts. 6m. what sum will remain? Ans. $7722 23cts. 8m.

2 If I subtract $125 84cts. from $4683 2cts. and multiply the remainder by 4, what will be the result?
Ans. $12256 72cts.

3 A person hires a house for $250, he pays his taylor $14 73cts. his shoe-maker $18, his fire wood costs him $43 18cts. his butcher's bill is $87 40cts. his baker's $59, and by his trade he clears $500 yearly; is he making or loosing money?
Ans. Saves $27 69cts.

4 A teacher, who had 48 scholars, distributed equally among $\frac{1}{3}$ of his number, for their diligence, 8 cents a piece; how much money did he give them? Ans. $1 28cts.

5 Calculate the amount of articles in the following bill:

Nine-Partners, 5th mo. 1816.

J. White — Bought of J. King.

19 yds. of lace,	at	$2 37½ cts. per yard	
14 do. of ribbon	at	18¾ ——	
24 do. do	at	25 ——	
3 pair of gloves	at	27 per pair.	
13 fans	at	13½ each.	
2 pair of knots	at	25 per pair.	

Amount $58 16¼ cts.

TABLES OF WEIGHTS AND MEASURES, &c.

1. ENGLISH MONEY.

4 Farthings	make 1	Penny marked qrs.	d
12 Pence		Shilling	s
20 Shillings		Pound	£

Note—Farthings are marked thus :

¼ one farthing.
½ two farthings, or halfpenny.
¾ three farthings.

PENCE TABLE.

d	s	d	s	d	s	£	s
20	= 1 :	8	2	= 24	20	= 1 :	0
30	= 2 :	6	3	= 36	30	= 1 :	10
40	= 3 :	4	4	= 48	40	= 2 :	0
50	= 4 :	2	5	= 60	50	= 2 :	10
60	= 5 :	0	6	= 72	60	= 3 :	0
70	= 5 :	10	7	= 84	70	= 3 :	10
80	= 6 :	8	8	= 96	80	= 4 :	0
90	= 7 :	6	9	= 108	90	= 4 :	10
100	= 8 :	4	10	= 120	100	= 5 :	0
110	= 9 :	2	11	= 132	110	= 5 :	10
120	= 10 :	0	12	= 144	120	= 6 :	0

2. TROY WEIGHT.

24 grains (gr.)	make 1	Penny weight,	dwt.
20 Penny-weights	1	Ounce,	oz.
12 Ounces	1	Pound,	℔

Note—By this weight, jewels, gold, silver, and liquors are weighed.

3. AVOIRDUPOIS WEIGHT.

16 drams (dr.)	make	1 ounce,	oz.
16 ounces		1 pound,	℔
28 pounds		1 qr. of a hund. wt.	qr.
4 qrs. (or 112℔)		1 hundred weight,	cwt.
20 hundred weight		1 ton	T.

Note—By this weight are weighed all coarse and drossy goods, grocery wares, and all metals except gold and silver.

4. APOTHECARIES WEIGHT

20 grains (gr.)	make	1 scruple,	℈
3 scruples		1 dram,	ʒ
8 drams		1 ounce,	℥
12 ounces		1 pound,	℔

Note—By this weight apothecaries mix their medicines, but buy and sell by Avoirdupois weight.

5. CLOTH MEASURE.

2¼ inches (in.)	make	1 nail,	na.
4 nails		1 qr. of a yd.	qr.
4 quarters		1 yard,	yd.
3 quarters		1 Ell Flemish,	E. Fl.
5 quarters		1 Ell English,	E. E.
6 quarters		1 Ell French,	E. Fr.

Note—By this measure are measured cloth, tapes, &c.

6. LONG MEASURE.

3 barley corns (bc.)	make	1 inch,	in.
12 inches		1 foot,	ft.
3 feet		1 yard,	yd.
5½ yards, or 16½ ft		1 rod, perch or pole,	[pol.
40 poles		1 furlong,	fur.
8 furlongs		1 mile,	m.
3 miles		1 league,	L.
60 geographic, or 69½ statute	miles	1 degree,	deg.
360 degrees		a great circle of the earth.	

Note—By this measure are measured the distance of place, or any thing where length is considered, without any regard to breadth.

A hand is 4 inches and used in measuring the height of horses.

A fathom is 6 feet and is chiefly used in measuring the depth of water.

A chain contains 100 links and is 66 feet or 4 rods.

LAND OR SQUARE MEASURE.

144 inches (in.)	make	1 foot,	ft.
9 feet		1 yard,	yd.
30¼ yards		1 rod, or perch	rd.
40 rods		1 rood	r.
4 roods (or 160 rods)		1 acre,	a.
640 acres		1 mile.	m.

Note—This measure is used in reckoning the content of land, or *things that have length and breadth.*

SOLID OR CUBIC MEASURE.

1728 inches	make	1 foot.	ft.
40 feet of round timber, or 50 feet of hewn timber,	make	1 ton.	T.
128 feet, or 8 feet long, 4 feet high, and 4 feet wide	make	1 cord of wood.	C.

Note—This measure is used when things have length, breadth, and depth.

LIQUID MEASURE.

4 gills (gil.)	make	1 pint,	pt.
2 pints		1 quart,	qt.
4 quarts		1 gallon,	gal.
31½ gallons		1 barrel,	bar.
63 gallons		1 hogshead,	hhd.
2 hogsheads		1 pipe or butt,	pi. or bt.
2 pipes (or 4 hogsheads)		1 tun.	T.

Note—This measure is used for beer, cider, wine, &c.

DRY MEASURE.

2 pints (pt.)	make	1 quart	qt.
8 quarts		1 peck,	pe.
4 pecks		1 bushel.	bu.

Note—This measure is used for grain, fruit, salt, &c.

TIME.

60 seconds (sec.)	make	1 minute,	min.
60 minutes		1 hour,	H.
24 hours		1 day,	D.
7 days		1 week,	W.
52 weeks, 1 day, and six hours, or 365 days and 6 hours,		1 year.	Y.
12 months (mo.)		1 year.	

Note—By the calendar, the year is divided in the following manner:

1	Month	January hath	31 days
2		February	28 days
3		March	31
4		April	30
5		May	31
6		June	30
7		July	31
8		August	31

9	September	30
10	October	31
11	November	30
12	December	31

Or Thirty days hath September,
April, June, and November,
All the rest have thirty one,
Except February alone,
Which hath four and twenty-four,
And every fourth year one day more,

Note—The six hours in each year are not reckoned till they amount to one day: hence, a common year consists of 365 days, and every fourth, called leap year, of 366 days.

When the year can be divided by 4 without any remainder, it is then Leap Year, in which 2d month (February) has 29 days.

The fourth, eleventh, ninth and sixth,
Have thirty days to each affix'd
And every other thirty-one,
Except the second month alone,
Which has but twenty-eight in fine,
Till leap year gives it twenty-nine.

CIRCULAR MOTION.

60 seconds (″)	make	1 minute, ′
60 minutes		1 degree, °
30 degrees		1 sign, S
12 signs, or 360 degrees		1 great circle of the horizon.

Note—This table is used by astronomers, navigators, &c.

COMPOUND ADDITION.

Compound Addition teaches to add together several sums or quantities of different denominations.

RULE.

1. Place the numbers of the same denomination under each other, and separate the different denominations by a space or by dots.

2. Then begin at the right hand column, and add up as in Simple Addition; divide the amount by as many of that denomination as will make one of the next greater, set down the remainder (if any) under said column, and carry the quotient to *the next* which must be added up and divided in *the same manner*, and so proceed through all the denominations.

PROOF.

The same as in Simple Addition.

ENGLISH MONEY.

£.	(20) s.	(12) d.	(4) qrs.
487	13	8	1/4
512	06	4	1/2
671	14	3	1/4
764	18	10	3/4
2436	13	3	1/4
1948	19	6	1/2
2436	13	3	1/4

£.	s.	d.
84	14	9
14	5	7
89	11	8
14	19	9

£.	s.	d
61	13	5
76	14	11 3/4
86	3	9 1/4
95	17	6 1/2

sum of shil. 20)53(2 40 — 13

sum of pence 12)27(2 24 — 3

sum of farth. 4)9(2 8 — 1/4

£.	s.	d.
17	13	11
13	10	2
10	17	3
8	14	8
16	5	10

£.	s.	d. qrs.
181	14	0 1/4
143	13	7
146	0	8 1/4
43	19	5 1/2
6	16	4 3/4

£.	s.	d. qrs.
87	3	1
42	8	5
9	18	3 3/4
6	14	5
84	13	5

£	s.	d. qrs.
47	17	6 1/2
8	9	10 3/4
59	17	11 1/2
317	16	9 3/4
764	18	10 1/4
407	17	6

£.	s.	d.
7	17	10
60	6	8 1/2
14	14	11
3	18	0
98	14	5 3/4
34	0	3

£.	s.	d.
541	0	0
711	9	8 1/4
916	3	5 3/4
140	15	10 1/2
374	8	5
300	15	6 1/4

10. Add the following sums, viz. £16 6s 4d; £85 13s 3d; £43 and £84.

11. Add £35 12s 2d; £66 18s; £352 17s; and £2 19s 2½d.

12. Add £145; £72 0s 8d; £15 9s 8½d; 18s 5¾d; and £43 2s 3¾d.

13. Add £420 6s; £1800 15s and £4438 19s.

TROY WEIGHT.

lb	oz.	dwt.	gr.	lb	oz.	dwt.	gr.	lb	oz.	dwt.	grs
7	10	11	15	21	4	13	16	33	7	10	13
2	1	8	9	78	7	6	8	65	10	4	17
4	6	7	12	36	5	10	14	48	6	12	23
5	5	12	12	63	6	9	10	76	3	13	5
9	11	13	14	78	9	18	23	41	4	19	4

4. Add 2lb 11oz. 10dwt. 2gr.; 15lb. 10oz. 2dwt.; and 145lb 2oz. 2dwt.

5. Add 14lb 3oz.; 3lb 0oz. 13dwt.; 16lb. 5oz. 14dwt.; and 25lb. 6oz.

AVOIRDUPOIS WEIGHT.

T.	cwt.	qrs.	T.	cwt.	qrs.	lb.	Cwt.	qr.	lb.	oz.	dr.
40	11	3	3	19	3	27	8	3	12	15	8
16	10	2	2	12	1	13	12	1	4	3	6
18	0	1	10	14	1	0	84	2	46	0	5
9	12	0	14	3	2	16	41	3	25	8	14
4	3	2	1	8	0	5		2	4	5	6

4. Add 30 tons, 2 hundred weight, 2 quarters; 13 tons 2 quarters; and 3 tons.

5. Add 13 hundred weight, 3 quarters, 27 pounds; 17 hundred weight, 10 pounds; and 1 hundred weight, 15 pounds.

APOTHECARIES WEIGHT.

lb	℥	ʒ	℈	gr.	lb	ʒ	ʒ	℈	gr.
35	9	4	2	15	4	3	2	1	16
42	5	6	1	11	14	11	7	2	14
17	10	7	0	3		1	1	2	3
25	7	3	2	18		5	4	1	16
84	9	2	1	12				2	17

3. Add 11 pounds, 7 drams, 1 scruple: 15 pounds, 10 ounces, 2 drams; 54 pounds, 4 ounces; and 46 pounds.

4. Add 15 *pounds*, 2 ounces; 1 pound, 2 grains; 4 ounces, *1 dram, 2 scruples*; and 4 drams, 12 grains.

CLOTH MEASURE.

Yds.	qr.	na.	E.E	qrs.	na.	E Fl.	qrs.	na.
17	1	1	14	1	2	17	1	2
11	3	1	17	3	1	17	1	3
16	1	2	14	4	1	14	1	2
19	3	1	16	3	2	16	2	0
12	3	3	19	1	1	14	0	0

4. Add 15 yards, 3 quarters, 2 nails; 45 yards, 2 quarters; 1 yard, 3 nails; and 125 yards.

5. Add 14 English ells, 3 quarters; 25 English ells, 2 quarters, 3 nails; and three quarters, 1 nail.

LONG MEASURE.

Yds.	ft.	in.	M.	fur.	pol.	Le.	m.	fur.	pol.
4	2	11	46	4	16	86	2	6	32
3	1	8	58	5	23	52	1	7	16
1	2	9	9	6	34	64	2	5	19
6	2	10	17	4	18	73	1	4	15
1	0	6	7	3	15	7	2	3	10

4. Add 13 leagues, 2 miles, 6 furlongs; 4 leagues, 4 furlongs, 32 poles; 1 league, 2 miles, 18 poles; and 20 leagues.

5. Add 2 yards, 1 foot, 9 inches; 1 yard, 11 inches; 1 foot, 6 inches; and 10 yards, 5 inches.

LAND MEASURE.

A.	r.	p.	A.	r.	p.	Yds.	ft.
75	3	2	150	3	39	8	2
21	1	30	265	2	12	10	1
16	2	25	173	1	14	15	2
17	3	20	8	3	0	16	1
14	1	25	16	2	5	8	0

4 Add 125 acres, 3 roods; 401 acres, 2 roods, 28 perches; 56 acres, 20 perches; 540 acres.

5 Add 15 yards, 2 feet; 2 yards, 1 foot; 16 yards, 2 feet; *and 28 yards.*

SOLID OR CUBIC MEASURE.

Ton.	ft.	in	Cord,	ft.	in.
29	36	1229	27	119	1015
12	19	64	19	110	159
18	2	7	48	127	1071
19	8	164	8	111	956
6	3	58	3	26	45

3. Add 36 tons, 45 feet : 86 feet; 1 foot, 1641 inches; and 32 feet 45 inches.

4. Add 75 cords, 31 feet, 172 inches : 364 cords, 14 feet, 24 inches ; 49 feet, 12 inches ; and 113 cords.

LIQUID MEASURE.

T.	hhd.	gal	Hhd.	gal.	qt.	gal.	qt.	pt.
13	8	146	3	15	3	25	2	0
11	2	18	5	13	1	15	1	0
24	1	0	11	7	2	6	3	0
21	0	14	14	3	0	8	1	1
13	2	12	15	1	1	6	2	0

4. Add 11 tuns, 3 hogsheads, 16 gallons ; 4 tuns, 2 hogsheads, 9 gallons ; 2 hogsheads, 40 gallons ; and 14 tuns.

5. Add 14 gallons, 3 quarts, 1 pint ; 25 gallons, 2 quarts ; 2 gallons, 2 pints ; 23 gallons.

DRY MEASURE.

bu.	p.	qt.	bu.	p.	qt.	bu.	p.	qt.	pt.
26	3	2	10	3	2	36	1	1	1
16	1	1	118	2	3	49	2	2	1
24	2	0	216	2	4	50	3	6	0
40	3	2	450	3	2	17	2	3	1
36	1	0	111	1	1	46	0	0	0

4. Add 116 bushels, 3 pecks, 6 quarts ; 341 bushels, 1 peck ; 40 bushels, 6 quarts ; and 375 bushels.

5. Add 3 bushels, 3 pecks, 4 quarts, 1 pint ; 6 bushels, 1 peck, 2 quarts ; and 1 peck, 5 quarts, 1 pint.

TIME.

y.	m.
74	3
14	10
13	6
18	11
18	5

w.	d.	h.	min
2	1	10	30
1	6	9	36
3	5	22	45
2	3	6	14
3	1	1	16

d.	h.	min.	sec.
4	20	56	54
3	17	20	28
2	8	0	3
	7	5	14
		6	5

Add 20 years, 4 months; 45 years, 6 months; 81 years, 10 months; 16 years; and 100 years.

5. Add 6 weeks, 1 day, 5 hours, 45 minutes; 3 weeks, 4 days, 20 hours; 3 days, 18 hours, 14 minutes; and 8 hours.

MOTION.

°	′	″
71	13	14
12	14	45
83	6	4
17	10	11
36	5	0

S.	°	′	″
5	20	13	47
1	10	12	36
17	5	18	14
3	11	7	9
5	5	0	50

PROMISCUOUS EXAMPLES.

1. Bought a Geography for 8s 6d.½; an English Reader for 6s. 8d.; an Arithmetic for 4s. 6d.; a slate for 2s. 6d. and a penknife for 3s. 6d.½; what do they all come to?

Ans. £1 5s. 9d.

2. If a man buys a farm for £3400 16s.; he pays £132 4s. 8d. for the stock on it; for a stack of hay £15; for carts, ploughs, &c. £45 3s. 4d. and for a bin of wheat £30 14s. what will the whole cost him? Ans. £3623 18s. 0d.

3. Admitting I buy of a shop keeper, cloth for a coat that costs me £5 4s. 3d.; the lining 16s 8d.; buttons 4s. 5d.; I likewise get a bandanna handkerchief for 10s. 6d.: Query, what is the bill against me? Ans. £6 15s. 10d.

4. Bought of a silversmith, dishes weighing 16lb. 10oz; 13dwt.; plates weighing 35lb. 10oz. 11dwt. and tea spoons. 2lb. 10 oz.; what was the weight of the whole?

Ans. 55lb. 7oz. 4dwt.

5. Bought 3 hogsheads of sugar, weighing as follows, viz. No. 1, 0cwt. 2qr. 18lb; No. 2, 8cwt. 3 qr. 12lb.; No. 3, 7 cwt. 2qr. 19lb.; how much is the amount?

Ans. 26cwt. 0qr. 21lb.

6. Admit a man travelled in one day, 27 miles, 2 furlongs; in another 32 miles, 7 furlongs, 33 perches; in another 19 miles, 7 furlongs, 16 perches; and in another 12 miles, 5 furlongs; how far did he travel in all?

Ans. 92 m. 6 fur. 9 perches.

7. A landlord has 4 farms, the first contains 120 acres, 3 roods, the second 150 acres, the third 215 acres 1 rood, and the fourth 90 acres, 2 roods, 20 perches; How many acres in all?

Ans. 582A. 2R. 20P.

8. A person was born in New-York, lived in that place until he was 18 years and 3 weeks old; he then went to New-Haven, spending 2 days on the road; he resided there 3 years and 6 months, and then moved to Hartford, he was but 1 day on the road; he remained in Hartford 1 year 2 months and 3 weeks, and then moved to Albany, being 5 days in travelling thither; he has been in Albany 12 years and 6 days, what will be his age in 2 weeks from this time.

Ans. 34y. 10m. 2w.

COMPOUND SUBTRACTION.

Compound Subtraction teaches to take one quantity of several denominations from a greater of like quality.

RULE.

1. Place the quantities as in compound addition, with the less under the greater.

2. Begin at the right hand and take the under from the upper.

3. When the lower number is greater than the upper, take it from as many of that denomination as will make one of the next greater, and to the remainder add the upper number, set down the result, and carry one to the next.

PROOF.

Add the remainder to the less number.

EXAMPLES.

	£.	(20) s.	(12) d.
From	8	12	7
Take	4	6	3
	4	6	4

	£.	(20) s.	(12) d.
	18	5	4
	9	13	8
	8	11	8

	£.	(20) s.	(12) d.	(4)
	153	17	6	$\frac{1}{2}$
	121	13	10	$\frac{3}{4}$
	22	3	7	$\frac{1}{4}$

£.	s.	d.
7	15	4
5	6	1

£.	s.	d.
26	14	3
16	18	9

£.	s.	d.
25	3	6
14	5	2

£.	s.	d.
48	3	4
12	1	7

£.	s.	d.
45	8	$5\frac{3}{4}$
21	3	$7\frac{1}{4}$

£.	s.	d.
185	9	$5\frac{1}{2}$
73	15	$4\frac{3}{4}$

£.	s.	d.
18	16	$3\frac{1}{4}$
6	5	$7\frac{3}{4}$

£.	s.	d.
463	16	$7\frac{3}{4}$
129	5	$10\frac{1}{4}$

£.	s.	d.
16	5	$4\frac{1}{2}$
	18	$3\frac{3}{4}$

£.	s.	d.
100	0	$6\frac{1}{2}$
	15	$0\frac{1}{4}$

£	s.	d.
100	0	0
		9

£.	s.	d.
30	0	0
8	16	$5\frac{3}{4}$

£.	s.	d.
1000	0	0
		$\frac{3}{4}$

17. Subtract 25 pounds, 10 shillings and 6 pence; from 38 pounds, 7 shillings and 2 pence.

18. Subtract 26 pounds; from 150 pounds, 16 shillings and 3 pence.

19. Subtract 8000 pounds, 14 shillings; from 10000 pounds, 18 shillings. and $6\frac{3}{4}$ pence.

20. From 86 pounds; take 1 shilling.

TROY WEIGHT.

	lb	oz.	dwt.	gr.	lb	oz.	dwt.	gr.
From	27	0	11	10	48	10	6	17
Take	9	8	1	18	19	9	19	21
Rem.								

3. Subtract 18 pounds, 6 ounces; from 125 pounds, 4 ounces, 16 pennyweights.

4. Subtract 1 pound, 3 ounces, 10 pennyweights, 16 grains; from 15 pounds, 3 grains.

AVOIRDUPOIS WEIGHT.

	T.	C.	qr.	T.	C.	qr.	lb	C.	qr.	lb	oz.	dr.
From	43	16	2	52	12	3	15	17	1	12	14	15
Take	19	18	1	24	14	2	26	6	3	21	15	9
Rem.												

4. Subtract 76 tons, 18 cwt. 3 quarters; from 183 tons, 1 cwt. 3 quarters.

5. Subtract 15 pounds, 4 ounces, 6 drams; from 20 pounds, 2 ounces.

APOTHECARIES WEIGHT.

lb	℥	ʒ	℈	gr.	lb	℥	ʒ	℈	gr.
9	1	2	2	12	28	10	4	1	10
6	10	1	1	19	17	6	7	2	8

3. Subtract 16 pounds, 5 ounces, 2 drams; from 24 pounds, 10 ounces, 3 drams.

4. Take 3 ounces, 2 drams, 1 scruple; from 8 pounds, 6 ounces, 1 dram, 4 grains.

CLOTH MEASURE.

Yds.	qrs.	n.	E. E.	qrs.	n.	E. F.	qrs.	n.
47	1	0	42	0	3	71	1	1
35	2	2	16	3	1	67	2	0

4. Subtract 95 yards, 1 quarter, 2 nails; from 137 yards, 2 quarters, 3 nails.

5. Subtract 12 English ells, 2 quarters, 1 nail; from 83 English ells, 1 quarter, 2 nails.

LONG MEASURE.

L.	m.	fur.	L.	m.	fur.	p.	yds.	ft.	in.
24	1	7	37	0	2	19	6	2	5
18	1	4	16	1	3	12	3	2	8

4. Subtract 43 miles, 5 furlongs, 21 poles; from 420 miles, 3 furlongs, 25 poles.

5. Subtract 15 yards, 1 foot, 3 inches; from 37 yards, 8 inches.

LAND MEASURE.

A.	R.	P.	A.	R.	P.	A.	R.	P.
96	3	23	192	2	2	25	2	1
16	1	29	24	3	2	3	1	19

4. Subtract 32 acres, 2 roods, from 800 acres, 3 roods, 16 perches.

5. Subtract 83 acres; from 365 acres, 1 rood, 30 perches.

SOLID OR CUBIC MEASURE.

Tons.	ft.	in.	Cords.	ft.	in.
29	36	1229	27	110	123
12	42	54	9	119	1015

3. Subtract 13 tons, 16 feet; from 30 tons, 8 ft. 127 inches.

4. Subtract 18 cords, 8 feet, 19 inches; from 183 cords, 2 feet, 137 inches.

LIQUID MEASURE.

Tuns.	hhd.	gal.	Hhd.	gal.	qt.	Gal.	qt.	pt.
85	3	45	46	14	2	76	3	1
17	1	60	28	3	3	22	1	0

4. Subtract 14 tuns, 3 hogsheads, 10 gallons; from 30 tuns, 2 hogsheads, 12 gallons.

5. From 85 hogsheads, 13 gallons, 3 quarts, 1 pint; take 21 hogsheads, 2 quarts.

DRY MEASURE.

Bu.	pe.	qt.	Bu.	pe.	qt.	Pe.	qt.	pt.
98	3	1	67	2	1	4	6	0
41	0	2	34	3	2	2	7	1

4. Subtract 123 bushels, 2 pecks, 1 quart; from 173 bushels.

5. Subtract 321 bushels; from 601 bushels, 2 pecks.

TIME.

Y.	mo.	W.	d.	h.	D.	h.	min.	sec.
83	3	37	6	21	83	13	30	25
21	8	13	4	22	15	17	21	34

4. Subtract 125 years, 9 months; from 365 years 6 months.

5. Take 131 days, 18 hours, 30 minutes; from 201 days, 19 hours.

MOTION.

S.	°	′	″	S.	°	′	″
9	23	45	54	9	29	34	54
3	7	40	56	6	29	40	36

APPLICATION.

1. A merchant has in his desk £375 10s. If he take out £122 11s. 3d. to pay for goods, how much will remain?

Ans. £252 18s. 9d.

2. A person borrowed of me 187*l.* and has paid me £89 15s. 4½d; how much yet remains unpaid?

Ans. £97 4s. 7½d.

3. If a person buy a quantity of wheat for £1393 3 qrs. and sell the same for 2090*l.*; how much does he make by the sale?

Ans. £106 19s. 11½d.

4. A silversmith had 34 pounds, 9 ounces, 10 pennyweights of silver, and melts 19 pounds, 15 pennyweights, 10 grains; how much has he left. Ans. 15lb. 8oz. 14dwt. 14gr.

5. If out of 6 pounds, 10 ounces, 6 drams, 2 scruples, of medicine, be taken 4 pounds, 5 ounces, 4 drams, 1 scruple, 17 grains; what quantity will remain?

Ans. 2lb 5℥. 2ʒ. 0℈. 3grs.

6. The distance from Albany to Hudson is about 30 miles, 1 furlong, and 15 poles. A person going from one place to the other, stopped at an inn, when he had travelled 18 miles, 3 furlongs, and 30 poles; how much farther has he still to go?

Ans. 11miles 5fur. 25poles.

7. Bought 145 yards, 3 quarters of cloth, and sold thereof 95 yards, 2 quarters, 3 nails; how much remains?

Ans. 50yds. 1n.

8. A farmer had 500 acres, 1 rood of land, one of his sons having married, he gave him 150 acres, 3 roods, 25 perches; how much had he remaining?

Ans. 349 acres, 1 rood, 15 perches.

9. Bought several casks of cider, containing 154 gallons, 2qts. and disposed of one which contained 41 gallons, 2qts. 1 pint; how much is there in the other casks?

Ans. 112 gal. 3 qts. 1 pt.

10. Out of a granary which contained 283 bushels of corn, there was taken 158 bushels, 2 pecks, 5 quarts; what quantity remains? Ans. 129 bush. 1 peck 3 qts.

14. William was bound as an apprentice for 7 years. He has served 3 years and 5 months; how long has he still to serve? Ans. 3 years 7 months.

12. Henry was born on the 20th of 8th mo. 1789, and Charles on the 18th of the 9th month 1808; what is the difference of their ages? Ans. 19y. 29 days.

13 A bond was given 21st of 5th month (May) 1809, and was taken up the 12th of 3rd month (March) 1815; what time elapsed from the day the bond was given, till the day it was taken up? Ans. 5 years, 9 mo. 22days.

NOTE.—The interval or space of time between two given dates is thus found:—Set the prior date under the subsequent date; and, when the lower number of days is greater than the upper, take it from as many days as are in the month of the prior date, add the difference to the upper number and set down the amount; then carry 1 to the months of the prior date, and subtract as in the foregoing examples.

COMPOUND MULTIPLICATION.

Compound Multiplication teaches to multiply numbers or quantities, consisting of divers denominations.

CASE 1.

When the multiplier does not exceed 12.

RULE.

1. Place the multiplier under the lowest denomination of the given quantity.

2. Multiply each denomination of the given sum by the multiplier; if the product be not equal to the next higher denomination, set it down.

3. But if the product be equal to, or more than the next higher denomination, then divide it by as many of that denomination as will make one of the next, set down the remainder (if any) and add the quotient to the product of the next denomination, and so proceed.

EXAMPLES.

Prod. of pence.	prod. of farths.	(20)(12)(4) £. s. d.	£ s. d.
8	3	8 14 8 3/4	5 13 3
2	2	2	2
12)17(1	4)6(	17 9 5 1/2	
12	1 2/4		
5			

prod. of shillings.
14
2
20)29(1
20
9

£	s.	d.	£.	s.	d.	qrs.	£	s.	d.
10	15	6	16	11	7	1/4	12	8	9
		3							4

£	s.	d.
62	5	4¼
		5

£	s.	d.
57	2	4¼
		6

£	s.	d.
35	12	7⅝
		7

WEIGHTS AND MEASURES.

lb.	oz.	dwt.	gr.
17	5	12	6
			3

T.	ewt.	qrs.	lb.	oz.	dr.
5	16	3	12	1	14
					4

L.	m.	fur.
15	2	7
		6

Yds.	ft.	in.	b.c.
14	1	10	2
			7

Yds.	qr.	na.
14	1	2
		10

A.	r.	p.
47	3	15
		9

Bush.	pe.	qt.
6	2	6

W.	d.	h.	min.	sec.
3	6	19	30	20
				4

Deg.	'	"
30	15	12
		8

CASE 2.

When the given multiplier exceeds 12, and is the exact product of some two factors in the multiplication table.

RULE.

Multiply the given sum by one of said factors, and that product by the other; the last product will be the answer.

EXAMPLES.

	£	s.	d.
1. 14 yards at	0	17	6
			2+7=14
	1	15	0
			7
	12	5	0

	£	s.	d.
	0	17	6
			7
	6	2	6
			2
Proof	12	5	0

		£	s.	d.		£	s.	d.
2	Multiply	0	9	6	by 18	Facit 8	11	0
3		0	7	7½	by 21	8	0	1½
4		0	15	3½	by 35	26	15	2½
5		0	11	5¼	by 54	30	17	7½
6		7	9	6	by 66	493	7	0
7		9	18	11½	by 72	716	5	0

CASE. 3.

When the multiplier is not the exact product of any two factors in the multiplication table.

RULE.

1 Take two factors whose product is the least short of the multiplier, and multiply by them as before.

2 Multiply the given sum by the number which supplies the deficiency.

3 Add its product to the sum produced by the two factors, and their amount will be the answer.

EXAMPLES.

1 Multiply by 19	s.	d.		2 Multiply by 68	£	s.	d.	
			3×1					3×2
			3×6−1=19				11	
	11	0			22	13	9	
		6					6	
	3	6	0		136	2	6	
		8	8		4	2	6	
	3	9	8		140	5	0	

		£	s.	d.		£	s.	d.
3	Multiply	1	2	6	by 26	Facit 29	5	0
4		0	17	8	by 43	37	19	8
5		0	9	7	by 37	17	14	7
6		0	12	8	by 74	46	17	4
7		1	5	3	by 97	122	9	3

CASE 4.

When the multiplier is greater than the product of any two factors in the table.

RULE.

1. Multiply continually by as many tens except one, as there are figures in the multiplier.

2. Multiply the last product by the left hand figure of the multiplier (if more than 1.)

3. Multiply the given sum by the units figure of the multiplier.

4. Multiply the product of the first ten by the tens figure.

5. Then add their products together and their sum will be the answer.

EXAMPLES.

1 Multiply by 276

s.	d.	
1	$7\frac{1}{2}$	×6
	10	
16	3	×7
	10	
8	2	6
		2
16	5	0
	9	9
5	13	9
22	8	6

2 Multiply by 176

	d.	
	$6\frac{1}{2}$	×6
	10	
5	5	×7
	10	
2	14	2
1	17	11
	3	3
4	15	4

	£	s.	d.		£	s.	d.
3 Multiply	0	1	2	by 197 Facit	11	7	6
4	0	0	7	by 390	11	7	6
5	6	3	3	by 407	66	2	9
6	0	7	5	by 135	50	1	3
7	0	2	4	by 820	95	13	4
8	1	3	6	by 165	193	17	6

APPLICATION.

1 If one pound of sugar cost 1s. 1d. what will five pounds cost ? Ans. 5s. 5d.

2 If one yard of cloth cost 8s. $3\frac{1}{2}$d. what is the price of 6 yards ? Ans. 2l. 9s. 9d.

3 What will 8 bushels of wheat come to at 14s. 6d. per bushel ? Ans. 5l. 16s.

4 What will 9 hundred weight of flour amount to at 1*l.* 11s. 5d. per hundred weight ? Ans. 14*l.* 2s. 9d.

5 Sold 10 tons of hay at 6*l.* 17s. 4½d. a ton, what is the amount ? Ans. 68*l.* 13s. 9d.

6 Bought a piece of broad cloth containing 24 yards, at 15s. 3d. per yard, what is the amount ? Ans. 18*l.* 6s.

7 How much will 66 acres of land come to at 17*l.* 9s. 6d. an acre. Ans. 1153*l.* 7s.

8 Bought 63 gallons of wine at 5s. 4d. per gallon ; what was the amount ? Ans. 16*l.* 16s.

9 What cost a chest of tea weighing 98lb. at 5s. 6d. per lb. ? Ans. 26*l.* 19s.

10 Bought 39 cwt. of cheese at 1*l.* 5s. 6d. per cwt. what is the amount of the whole ? Ans. 49*l.* 14s. 6d.

11 If I hold 120 acres of land at 14s. 6d. per acre, what is my yearly rent ? Ans. 87*l.*

12 What is the value of 336 yards of linen at 2s. 5d. per yard ? Ans. 40*l.* 12s.

13 A Goldsmith bought 11 ingots of silver, each of which weighed 4 pounds, 1 ounce, 15 penny weights, 22 grains; what is the weight of the whole ? Ans. 45lb. 7oz. 15dwt. 2gr.

14 A grocer bought 5 hogsheads of sugar, weighing each 11cwt. 2qr. 16lb. ; how much did the whole weigh ? Ans. 58cwt. 0qr. 24lb.

15 There were 6 bags of corn, each containing 2 bushels, 3 pecks; how many bushels are there in the whole ? Ans. 16 bushels, 2 pecks.

COMPOUND DIVISION.

Compound Division teaches to divide any sum or quantity which consists of different denominations.

CASE 1.

When the divisor does not exceed 12.

RULE.

1 Divide the several denominations of the given sum one after another (beginning at the left hand) and set their respective quotients underneath.

2 When a remainder occurs in dividing either of the denominations, multiply it by the next lower denomination, and add in that denomination, which divide by the given

divisor, and if a remainder again occurs, proceed in the same manner.

3. If the number of either denomination be not large enough to contain the divisor, multiply it by the next lower denomination and add in that denomination, then divide and proceed as before.

PROOF.

Multiply the quotient by the divisor, and the product will be equal to the dividend.

EXAMPLES.

(20) (12)(4)

£.	s.	d.
6)743	8	4 ½
123	18	0 ¾
		6
Proof 743	8	4 ½

£

5 remainder.
20s. make 1 £.

100
8 Added

6)108

18s.

4d.
4 qrs. make 1 penny.

16
2 added

6)18

¾ qrs.

£.	s.	d.
2)47	14	8
3)66	19	11¼

£.	s.	d.
4)85	13	8¾
5)59	16	7½
6)34	18	2
7)56	10	7½
8)83	14	5
9)346	1	3½

lb.	oz.	dwt.	gr.
2)25	9	13	10

T.	cwt.	qr.	lb.	oz.	dr.
3)43	17	3	20	11	8

L.	m.	fur.	p.
5)420	1	4	13

A.	r.	p.
8)82	3	18

Yds.	qr.	na.
10)94	2	3

T.	hhd.	gal.	qt.	pt.
9)26	3	41	1	1

W.	d.	h.	min.	sec.
12)23	6	20	31	20

CASE 2.

When the dividing number is the exact product of some two factors in the multiplication table.

RULE.

Divide by one of said factors, and then divide that quotient by the other factor as before directed.

Divide £ 173 14 7 by 16

£.	s.	d.
4)173	14	7
4)43	8	$7\frac{3}{4}$
Ans. 10	17	$1\frac{3}{4}$

Divide £ 72 16 $7\frac{1}{2}$ by 24

£.	s.	d.
4)72	16	$7\frac{1}{2}$
6)18	4	$1\frac{3}{4}+2$
3	0	$8\frac{1}{4}+1$

	£.	s.	d.		£.	s.	d.
3 Divide	29	15	0	by 21	Ans. 1	8	4
4	27	16	0	by 32	0	17	$4\frac{1}{2}$
5	67	9	4	by 44	1	10	8
6	269	12	4	by 56	4	16	$3\frac{1}{2}$
7	202	13	6	by 121	1	13	6
8	34	4	0	by 144	0	4	9

CASE 3.

When the dividing number is not the exact product of any two factors in the table.

RULE.

Divide the greatest denomination by said number, as in Long Division; multiply the remainder, if any, by as many of the next denomination as make one of that, adding in the number of the next name; divide the product as before, and so proceed.

EXAMPLES.

Divide £ 36 s. 16 d. 3 by 19

	£	s.	d.
19)36 16 3(1 18 9 Quotient.	1	18	9×1
19			3
Remainder 17*l.*	5	16	3
Multiply by 20 shills. make 1*l.* & add in 16s.			6
19)356	34	17	6
19	1	18	9
166 Proof	36	16	3
152			

Rem. 14 shillings

Multiply by 12 pence in a shilling, and add in 3d.

19)171

171

	£	s.	d.	by	Facit £	s.	d.
2 Divide	113	13	4	31	3	13	4
3	38	17	5½	47	0	16	6½
4	189	14	0	95	1	19	11 +
5	47	12	6	147	0	6	5¼ +
6	3236	12	4½	654	4	18	11¼

APPLICATION.

1 Bought 4 bushels of salt for 17s. 6d. what was it per bushel? Ans. 4s. 4½d.

2 Sold 8 yards of linen for 3*l.* 11s. 8d. what was the price per yard? Ans. 8s. 11½d.

3 A laborer had 3*l.* 3s. for twelve days service; what was *that per day?* Ans. 5s. 3d.

4. If a hogshead of wine cost £16 16s. what was it a gallon ? Ans. 5s. 4d.

5. If a farm that contains 120 acres rents for 87*l.*, what is that an acre ? Ans. 14s. 6d.

6. What is the price of a bushel of wheat, when 42 bushels are sold for £17 13s. 6d. ? Ans. 8s. 9d.

7. Bought 230 bushels of apples for £26 16s. 8d. what were they per bushel ? Ans. 2s. 4d.

PROMISCUOUS EXAMPLES IN COMPOUND ADDITION, SUBTRACTION, MULTIPLICATON, AND DIVISION.

1. Bought two pieces of linen, one of which contained 30 yards, and the other 25 ; the price was 7s. 6d. per yard; what was the cost of the two pieces ? Ans. £20 12s. 6d.

2. Sold a piece of cloth containing 8 yards at £2 14s. per yard, and another piece containing 12 yards at £1 13s. 4d. per yard ; what is the amount of the whole ? Ans. £41 12s.

3. A person has £500 18. 9d. He owes to one man £25 10s. to another £76 18s. 9d. to another £175 10s. and to another 100*l.* What sum will he have left after paying these debts ? Ans. 123*l.*

4. A grocer has 10 bags of sugar, weighing each 120lb. and 3 bags weighing each 145lb. if he sell 630lb. what quantity will remain ? Ans. 1005lb.

5. Bought 4 pieces of linen, containing 21 yards, 3 quarters each, and 3 pieces containing 35 yards, 2 quarters each, from which was afterwards sold 141 yards ; what number of yards was then remaining ? Ans. 52yds. 2qrs.

6. A farmer has three farms, the first contains 125 acres, 3 roods ; the second 200 acres, 2 roods, 18 perches ; the third 175 acres 10 perches. He intends dividing these farms equally between his two sons ; what will be the share of each son ? Ans. 250A. 2R. 34P.

7. A person at his decease, left property to the amount of £3128 16s. His will directed that 300*l.* should be given to the poor, and the remainder equally divided amongst his 3 sons ; what was each of their portions ? Ans. £942 18s. 8d.

QUESTIONS IN FEDERAL MONEY.

What are the denominations of Federal Money, and what is the value of each?

Why do we add, subtract, multiply, and divide, in Federal Money in the same manner as in whole numbers?

Is it customary in reading sums in Federal Money to mention eagles and dimes?

How do we place the several sums in Addition of Federal Money to add them?

After having placed the different denominations, what is the rule for adding them?

How are the dollars, cents, and mills distinguished?

How is Addition of Federal Money proved?

How are the sums performed in Subtraction of Federal Money?

How is Multiplication of Federal Money performed?

How do we perform sums in Division of Federal Money?

When there are only dollars in the dividend, and we wish to have cents and mills as well as dollars in the quotient, how do we proceed?

When there are mills and cents in the dividend, how do we point off the quotient so as to know which are the mills, cents and dollars?

QUESTIONS IN WEIGHTS AND MEASURES.

What is the value of the denominations of English Money?

What are the marks used in English Money?

Repeat the Pence Table.

What are the denominations of Troy Weight?

What articles are weighed by Troy Weight?

What are the denominations of Avoirdupois Weight?

What articles are weighed by Avoirdupois Weight?

What are the denominations of Apothecaries Weight?

What is the use of Apothecaries Weight?

What are the denominations of Cloth Measure?

What is the use of Cloth Measure?

What are the denominations of Long Measure?

What is the use of Long Measure?

How much is a hand and what is its use ?
How much is a fathom and what is its use ?
How many links are there in a chain, and what is its length ?
What are the denominations of Land or Square Measure ?
What is the use of Land or Square Measure ?
What are the denominations of Solid or Cubic Measure ?
What is solid or Cubic Measure used for ?
What are the denominations of Liquid Measure ?
What is the use of Liquid Measure ?
What are the denominations of Dry Measure ?
What is Dry Measure used for ?
What are the denominations of Time ?
What are the names of the months, and how many days has each month respectively ?
What is meant by leap year ?
By what rule may we know whether a year is leap year or not ?
Repeat the verse which shows the number of days in each month ?
What are the denominations of Circular Motion ?
What use is made of Circular Motion ?
How many shillings make a pound ?
How many acres are there in a square mile ?
How many days are there in a year ?
How many quarters and pounds make a cwt. ?
How many furlongs make a mile ?
How many yards or feet make a rod ?
How many gallons make a hogshead ?
How many weeks are there in a year ?
How many square inches are there in a square foot ?
How many gallons make a barrel ?
How many feet in length, breadth, and height make a cord ?
How many quarters make a Flemish ell ?
How many ounces make a pound Troy Weight ?
How many geographical and statute miles make a degree ?
How many pecks make a bushel ?
How many hours make a day ?
How many rods or roods are there in an acre ?
How many hogsheads make a ton ?
How many grains make a scruple ?
How many ounces make a pound Avoirdupois weight ?

How many quarters make an Ell English?
How many miles make a league?
How many pence make a shilling?
How many months make a year?

QUESTIONS IN COMPOUND ADDITION.

What does Compound Addition teach?
How are the different denominations placed in Compound Addition to be added?
What is the rule for adding and carrying in Compound Addition?
How is Compound Addition proved?

QUESTIONS IN COMPOUND SUBTRACTION.

What does Compound Subtraction teach?
How are the quantities in Compound Subtraction to be placed?
Where do we begin the subtraction?
How do we proceed when the lower number is greater than the one above it?
How is Compound Subtraction proved?

QUESTIONS IN COMPOUND MULTIPLICATION.

What does Compound Multiplication teach?
Where must the multiplier be placed?
After placing the multiplier in its proper place what is then done?
When the product exceeds the next higher denomination how do we proceed?
When the multiplier exceeds 12 but is the exact product of two factors in the table, what is the rule?
When no two numbers multiplied together will produce the given multiplier what then is the rule?
What is the rule when the multiplier is greater than the product of any two factors in the table?

QUESTIONS IN COMPOUND DIVISION.

What does Compound Division teach?

What is the rule for dividing when the divisor does not exceed 12?

How is Compound Division proved?

When the dividing number is the exact product of two factors in the multiplication table, what is the rule?

How is the division performed when the dividing number is not the exact product of any two factors in the table?

A Table of Coins which pass current in the United States of North America, with their Sterling and Federal Value.

NAMES OF COINS.	Standing Weights.		Sterling Money of Great Britain.			Vermont, New-Hampshire, Massachusetts, Rhode-Island, Connecticut and Virginia.			New-York and North-Carolina.			New-Jersey, Pennsylvania, Delaware and Maryland.			South Carolina and Georgia.			Federal value. Dollars Cents Mills		
(GOLD.)	dwt.	gr.	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	D.	C.	M.
A Johannes.	18	0	3	12	0	4	16	0	6	8	0	6	0	0	4	0	0	16	00	0
An half Johannes.	9	0	1	16	0	2	8	0	3	4	0	3	0	0	2	0	0	8	00	0
A Doubloon.	16	21	3	6	0	4	8	0	5	16	0	5	12	6	3	10	0	14	93	3
A Moidore	6	18	1	7	0	1	16	0	2	8	0	2	5	0	1	8	0	6	00	0
An English Guinea.	5	6	1	1	0	1	8	0	1	17	0	1	15	0	1	1	0	4	66	7
A French Guinea.	5	5	1	1	0	1	7	0	1	16	0	1	14	6	1	1	0	4	60	0
A Spanish Pistole.	4	6	0	16	6	1	2	0	1	9	0	1	8	0	0	18	0	3	77	3
A French Pistole.	4	4	0	16	0	1			1	8	0	1	7	6	0	17	6	3	66	7
(SILVER.)																				
An Eng. or French Crown	18	0	0	5	0	0	6	8	0	8	9	0	8	3	0	5	0	1	10	0
The Dollar of Spain, Sweden or Denmark	17	6	0	4	6	0	6	0	0	8	0	0	7	6	0	4	8	1	00	0
An English Shilling.	3	18	0	1	0	0	1	4	0	1	9	0	1	8	0	1	1	0	22	2
A Pistareen	3	11	0	0	10¼	0	1	2	0	1	7	0	1	6	0	0	11	0	20	0

☞ All other Gold Coins of equal fineness, at 89 cents per dwt. and Silver at 111 cents per oz.

REDUCTION.

Reduction is the reducing a given sum or quantity to a different denomination, retaining the same value.

1. When large names are to be brought into small, as pounds into shillings, feet into inches, cwt. into pounds, &c.

RULE.

Multiply the greatest denomination by as many of the next less as will make one of the greater, adding in said less denomination (if any) and so proceed from one denomination to another, until it is reduced to the denomination required.

Note. Thus, if it be required to reduce pounds to farthings, first multiply by as many shillings as make a pound, adding in the odd shillings (if any,) which product will be shillings; then by as many pence as make a shilling, adding in the odd pence (if any,) this product will be pence; then by as many farthings as make a penny, adding in the odd farthings (if any,) and this product will be the farthings required: OR, if it be required to reduce Cwt. to ounces, first multiply by as many qrs as make an Cwt.; then by as many pounds as make a qr.; then by as many ounces as make a pound, and this last product will be ounces, observing to add in the odd denominations (if any) in their proper places; and so of any other question.

2. When small names are to be brought into large as pence into shillings, gallons into hogsheads, pounds into Cwt. &c.

RULE.

Divide the given denomination by as many of that as will make one of the next greater, and that quotient by as many as will make one of the next greater, and so on from one denomination to another, until it is brought to the denomination required.

If when dividing there should be a remainder it will be of the same name as the dividend.

Note. Thus, if it be required to bring pence to pounds, first divide the given denomination by as many pence as make a shilling, the Quotient will be shillings, and the remainder (if any) will be pence; then divide again this quotient by as many shillings as make a pound, and this quotient will be pounds, and the remainder (if any) shillings:—OR, if it should be required to bring pounds to Cwt. first divide by as many pounds as make a qr.; then divide again by as many qrs. as make an Cwt. this last quotient will be the Cwt. required, observing the same rule as before respecting remainders, when any ever.

PROOF.

Reduce the result of the operation back to its given name.

FEDERAL MONEY.

1. In 45dols. 3cts. 8m. how many mills? Ans. 45038mills.

Dol. cts. m.
45 3 8
100 *

4503
10

Ans. 45038 mills.

2. In 387652 mills how many dollars? Ans. $387 65c. 2m.

1(0)38765(2

1(00)387(65 : 2

$387, 65, 2 Ans.

Note. A sum of Federal Money, which consists of dollars and cents, or dollars, cents, and mills, is reduced to cents or mills, by simply removing the separating point or points: or, if mills are to be brought into cents, separate one figure to the right hand for mills, and the remainder will be cents; and if cents into dollars, separate two figures to the right hand for cents, and the remainder will be dollars.

3 In $53 how many cents? Ans. 5300cts.
4 In 43862 mills how many dollars? Ans. $43 86cts. 2m.
5 In 49 dols. 34 cts. how many cents? Ans. 4934 cts.
6 How many eagles in 1933 dimes? Ans. 19E. 3dols. 3c.
7 In 10 dols. 6 cts. how many mills? Ans. 10060m.
8 In 190004 mills how many dollars? Ans. 190dols. 4m.
9 In 16 dols. 41 cts. how many cents? Ans. 1641cts.

ENGLISH, OR STERLING MONEY.

1 In £24 how many pence? Ans. 5760 pence.

£
24

multiply by 20 because 20s. make one pound.

480 shillings.

multiply by 12 because 12d. make one shilling.

Ans. 5760 pence.

2 In 4s. how many pence? Ans. 48d.
3 In £8 how many shillings? Ans. 160s.
4 Reduce £43 into shillings. Ans. 860s
5 Bring £342 into shillings. Ans. 6840s.
6 In £16 how many shillings and pence?
Ans. 320s. 3840d.
7 Reduce £83 into shillings and pence. A. 1660s. 19920d.
8 In £24 how many shillings, pence, and farthings?
Ans. 480s. 5760d. 23040qrs.
9 In £1573 how many shillings, pence and farthings?
Ans. 31460s. 377520d. 1510080qrs.
10 In 20160 farthings how many pounds? Ans. £21.

Divide by 4 because 4 farthings make 1d. 4)20160 farthings.

—— by 12 —— 12d. make a shilling. 12)5040 pence.

—— by 20 —— 20s. make a pound. 2(0)42(0 shillings.

Ans. 21 pounds.

11 In 860 shillings how many pounds? Ans. £43.
12 In 580 shillings how many pounds? Ans. £29.
13 In 3840 pence how many shillings and pounds?
Ans. 320s. £16.
14 Bring 12480 farthings into pence, shillings and pounds.
Ans. 3120d. 260s. £13.
15 In 88 pounds how many pence? Ans. 21120d.
16 In 421 pounds how many farthings? Ans. 404160qrs.
17 Bring 89040 pence into pounds. Ans. £371.
18 In 49920 farthings how many pounds? Ans £52.
19 In 91£ 11s. 3¼d. how many farthings? Ans. 87902qrs.

£ s. d.
91 11 3¼

Multiply by 20 shillings in £1 and add 11s.

1831s.

—— by 12 pence in 1s. and add 3d.

21975d.

—— by 4 } farthings in 1d. and add 2 qrs.
(or 2 farthings.)

Ans. 87902qrs.

20 In 53£ 16s. how many shillings? Ans. 1076s.
21 Bring 4s. 8d. into pence. Ans. 56d.
22 In 8s. 7¼d how many farthings? Ans. 413qrs.
23 Reduce 37£ 14s. 6d. into pence. Ans. 9054d.
24 In 124£ 16s. 8¾d. how many farthings? Ans. 119843qrs.
25 In 48£ 9d how many pence? Ans. 11529d.
26 In 68853 farthings how many pounds?
Ans. 71£ 14s. 5¼d.

qrs.
4)68853
12)17213 + 1qr. (or ¼)
2(0)143(4 + 5d.
Ans. £71 14s. 5¼d.

27 In 329s. how many pounds? Ans. 16£ 9s.
28 In 136d. how many shillings? Ans. 11s. 4d.
29 Reduce 13172d. into pounds. Ans. 54£ 17s. 8d.
30 Bring 6529 qrs. into pounds? Ans. 6£ 16s. 0¼d.
31 In 16971 qrs how many pounds? Ans. 17£ 13s. 6¾d.
32 Reduce 21075 half pence into pounds. Ans. 45£ 3s. 1½d.

Note. That scholars may understand reduction well, it is sometimes necessary to exercise them with questions without answers, a few are therefore introduced.

1 In 15s. how many pence?
2 In 37£ how many shillings and pence?
3 In 235 qrs. how many pence?
4 In 8s. 7d. how many pence?
5 In 143214qrs. how many pounds?
6 In £1432 how many pence?
7 In 84£ 13s. 4d. how many pence?
8 In 54d. how many farthings?
9 Reduce 18s. 9½d. into farthings.
10 In 6s. 8d. how many pence?
11 In 3641s. how many pounds?
12 In 4283s. how many pence?
13 Reduce 8£ 3d. into pence?
14 Reduce 16s. 1½d. into half pence.
15 Reduce 4178qrs. into pounds.
16 In 4¼d. how many farthings?
17 In 15£ 3s. how many pence?

REDUCTION.

TROY WEIGHT.

1. In 47℔ 10oz. how many ounces, pennyweights and grains? Ans. 574oz. 11480dwt. 275520gr.
2. In 12960 grains of gold, how many ounces? Ans. 27oz.
3. In 3℔ 10oz. 7dwt. 5gr. how many grains? Ans. 22253.
4. How many pounds are there in 47128 grains of gold? Ans. 8℔ 2oz. 3dwt. 16gr.
5. Bought 7 ingots of silver, each containing 23℔ 5 oz. 7 dwt. how many grains? Ans. 945336 grains.

AVOIRDUPOIS WEIGHT.

1. In 3 tons, how many Cwt. qrs. and lbs.? Ans. 60cwt. 240qrs. 6720lbs.
2. In 89cwt. 3qrs. 14lbs. 12oz. how many ounces? Ans. 161068 ounces.
3. In 573440 drams, how many tons? Ans. 1 ton.
4. Bring 892245 ounces into tons. Ans. 24tons, 17cwt. 3qrs. 17lb. 5oz.
5. In 12 hhds. sugar, each 11cwt. 25lb. how many pounds? Ans. 15084.
6. In 27cwt. of raisins, how many parcels of 18lb. each? Ans. 168 parcels.

APOTHECARIES WEIGHT.

1. In 9℔ 8ʒ 1ʒ 2℈ 19 grs.; how many grains? Ans. 55799 grs.
2. In 69721 grains, how many pounds? Ans. 12℔. 1ʒ. 2ʒ. 0℈. 1gr.

CLOTH MEASURE.

1. In 95 yards, how many quarters and nails? Ans. 380 qrs. 1520 na.
2. In 17yds. 1qr. 2na. how many nails? Ans. 278 nails.
3. In 3783 nails, how many yards? Ans. 236yds. 1q. 3na.
4. In 56 ells Flemish, how many quarters and nails? Ans. 168 qrs. 672 nails.
5. How many ells English in 5932 nails? Ans. 296 ells. 3 qrs.
6. In 10 bales of cloth, each 10 pieces, and each piece 12 yards, how many yards? Ans. 1200 yards.

LONG MEASURE.

1. In 57 miles, how many furlongs and poles ?
Ans. 456 fur. 18240 poles.

2. In 4352 inches, how many yards ?
Ans. 120yds. 2ft. 8in.

3. How many inches from New-York to Albany, it being 160 miles ? Ans. 10137600 inches.

4. In 682 yards, how many rods or poles ?
Ans. $682 \times 2 + 11 = 134$ rods.

5. Reduce 2280060 barley-corns to miles ?
Ans. 11m. 7fur. 38p. 2yds. 2ft.

6. How many barley-corns will reach round the globe of the earth, which is 360 degrees, and each degree $69\frac{1}{2}$ miles ?
Ans. 475580160.

LAND OR SQUARE MEASURE.

1. In 40 acres, how many roods and perches ?
Ans. 160 roods, 6400 perches.

2 In 17a. 3r. 10p. how many perches ? Ans. 2850per.

3. Reduce 4392 perches into acres. Ans. 27a. 1r. 32p.

4. If a piece of ground contain 24 acres, and an enclosure of 17 acres, 3 roods, be taken out of it, how many perches are there in the remainder ? Ans. 1000 perches.

SOLID MEASURE.

1. In 14 tons of hewn timber, how many solid inches ?
Ans. 1209600 inches.

2. In 19 tons of round timber, how many inches ?
Ans. 1313280 inches.

3. In 5667840 solid inches, how many tons of round timber ? Ans. 82 tons.

4. In 4608 solid feet of wood, how many cords ?
Ans. 36 cords ?

5. In a pile of wood 96 feet long, 5 feet high, and four feet wide, how many cords ? Ans. 15 cords.

6. What are the contents of a load of bark, 6 feet long, 4 feet high, and $2\frac{1}{2}$ feet wide.
Ans. 60 solid feet which is nearly $\frac{1}{2}$ a cord.

LIQUID MEASURE.

1. In 9 tuns of wine, how many hogsheads, gallons, and quarts. Ans. 36hhds. 2268gal. 9072qts.

2. In 10080 pints, how many tuns ? Ans. 5 tuns.

3. In 24 hogsheads, 18 gallons, 2 quarts, how many pints?
Ans. 12244 pts.
4. In 8 barrels, each 31½ gals. how many pints?
Ans. 2016 pts.

DRY MEASURE.

1. In 136 bushels, how many pecks, quarts and pints?
Ans. 544 pks. 4352 qts. 8704 pts.
2. In 486 qts. how many bushels? Ans. 15bu. 0pks. 6qts.
3 In 49 bushels, 3 pecks, 5 quarts, how many quarts?
Ans. 1597 qts.
4 A man would ship 720 bushels of corn, in barrels which hold 3 bushels, 3 pks. each, how many barrels must he get?
Ans. 192 barrels.

TIME.

1. In 121812 seconds, how many hours?
Ans. 33 hrs. 50 min. 12 sec.
2. In 41 weeks, how many days, hours, minutes and seconds? Ans. 287d. 6888h. 413280m. 24796800s.
3. How many seconds in a year, allowing it to be 365 days, 6 hours? Ans. 31557600 sec.
4. How many days in 18545485 seconds?
Ans. 214d. 15h. 31m. 25sec.
5. How many days from the birth of Christ, to Christmas 1815, allowing the year to contain 365 days, 6 hours?
Ans. 662928 days, 18 hrs.
6. From 2d of third month (March,) to the 19th of eleventh month, (November) inclusive, how many days?
Ans. 262 days.

CIRCULAR MOTION.

1. In 6 signs of the Zodiac, how many minutes?
Ans. 10800 min.
2. Bring 1020300 seconds into signs. Ans. 9signs, 13° 25′

CHANGING OF CURRENCIES.

1. To change the currency of each state to Federal Money.

RULE.

Divide the given sum, reduced to shillings, to sixpences, or to pence, by the number of shillings, sixpences or pence in a dollar, as it passes in each state.

(See table page 60.)

EXAMPLES.

1. Reduce 135*l.* 6s. New-York currency, to dollars. Ans. $338 25cts.

£ s.
135 6
20

8)2706

dol. 338+2
100

8)200

25 cents.

2. Change 573*l.* 4s. 6d. Pennsylvania currency, to dollars. Ans. $1528 60cts.

£ s. d.
573. 4 6
20

11464

1dol. 7s. 6d. or 15 sixpences 2 add 1

dols. cts.
15)22929(1528 60
15

79
75

42
30

129
120

9
100

15)900(60
90

3 Reduce 63*l.* 15s. New-England or Virginia currency to Federal money. Ans. $212 50cts.

4. Reduce 431*l.* New York currency to Federal money. *Ans.* $1077 50cts.

5. Reduce 28*l.* 11s. 6d. Virginia currency to Federal money. *Ans.* $95 25cts.

6. Reduce £53 18s. South-Carolina or Georgia currency to Federal money. *Ans.* 231 dolls.

7 Reduce £37 10s. Pennsylvania currency to Federal money. *Ans.* 100 dolls.

8. Reduce £214 10s. 7½d. New-York currency to Federal money. *Ans.* $536 32cts. 8m. +

9. Bring £20 18s. 5½d. New-England currency into Federal money. *Ans.* $69 74cts. 6m. +

2. To change Federal money to the currency of each state.

RULE.

Multiply the given sum in cents, by the number of pence in a dollar, and cut off two figures to the right of the product; what is left will be the answer in pence; and if the figures thus separated, be multiplied by 4, and two figures again cut off as before, those on the left hand will be the farthings.

EXAMPLES.

1. Reduce $425 7cts. to New-England currency.
Ans. £127 10s. 5d.

Cts.
42507
72 pence=to 6 shillings.

85014
297549

12)30605(04

2(0)255(0 5

127 10 5

2. Reduce $438 42cts. to New-York, &c currency.
Ans. £175 7s. 4½d. +

3. Reduce $1971 96cts. to New England or Virginia currency. *Ans.* £591 11s. 9d. +

4. Reduce $315 44cts. to Pennsylvania currency.
Ans. £118 5s. 9½d. +

5. Reduce $625 40cts. to South Carolina, &c. currency.
Ans. £122 11s. 10½d. +

6. Reduce $85 43cts. to Sterling money.
Ans. £19 4s. 5d. +

7. Reduce $254 28cts. to New-York currency.
Ans. £101 14s. $2\frac{3}{4}$d +

NOTE 3. When the given sum is dollars, multiply by the number of shillings in a dollar, thus; Dols.

1. Reduce 486 dolls. to N. York currency 486
8

2(0)388(8

£194 8s. *Ans.*

2. Reduce 721 dollars to New-England or Virginia currency. *Ans.* £216 6s.

3. Reduce 674 dollars to New-York currency.
Ans. £269 12s.

PROMISCUOUS QUESTIONS.

1. In £916 10s. $9\frac{3}{4}$ l. how many farthings? *Ans.* 879879qrs.

2. In 11316157 drams, how many tons?
Ans. 19tons. 14cwt. 2qrs 19lb. 11oz. 13drs.

3. Suppose a merchant had orders to ship 892cwt. 3qrs. 12lb. of beef, in barrels, each to contain 200lb. how many barrels will he want? *Ans.* 500 barrels.

4. How many dollars and cents, are equal to £124 8s. New-York currency? *Ans.* $311.

5. In 346 guineas at 21s. each, how many shillings and pence? *Ans.* 7266s. 87192d.

6. How many spoons weighing each 5oz. 10dwt. will 10lb. 1oz. of silver make? *Ans.* 22.

7. How many pints, quarts, and two quarts, each an equal number may be filled from a pipe of wine? *Ans.* 144.

8. In 50*l.* how many shillings, nine pences, six pences, four pences, and pence, and of each an equal number?
Ans. 375.

9. In 4 bales of cloth, each 12 pieces, and each piece 24 ells English, how many yards and ells Flemish?
Ans. 1440yards, 1920 ells Flemish.

10. How many marks, each 13s. 4d. are in £496 13s. 4d.
Ans. 745.

11. If a ship's cargo be 250 pipes, 130 hogsheads, and 150 half ditto; how many gallons in all? And allowing each pint to be a pound, what burden was the ship of?
Ans. 44415galls. ship's burden 158 tons, 12cwt. 2qr.

12 If 4yds. 1qr. 3na. of cloth will make a suit of clothes for one man, what quantity will be required to make one suit a piece for 425 men ? *Ans.* 1885yds. 3qrs. 3na.

13 One field contains 7 acres, another 10 acres, and a third 12 acres 1 rood ; how many shares of 76 perches each are contained in the whole ? *Ans.* 61 shares and 44 perches over.

14 How many times doth a wheel, which is 18 feet 6 inches round, turn between Albany and Utica, which is 93 miles ? *Ans.* 26542 times, and 156 inches over.

15 How long will it take to count a million at the rate of 50 a minute ? *Ans.* 333h. 20m. or 13d. 21h. 20m.

VULGAR FRACTIONS.

A vulgar fraction is a part, or parts of a unit or integer, expressed by two numbers, placed one above the other with a line drawn between them, as $\frac{1}{4}$ one fourth, $\frac{2}{3}$ two thirds, &c.

The number above the line is called the numerator, and that below the line, the denominator.

A fraction is said to be in its least or lowest terms, when it is expressed by the least numbers possible, as $\frac{4}{8}$ when reduced to its lowest terms, will be $\frac{1}{2}$, and $\frac{9}{12}$ is equal to $\frac{3}{4}$, &c.

CASE 1.

To reduce Fractions to their lowest terms.

RULE.

Divide the greater term by the less, and that divisor by the remainder, till nothing be left ; the last divisor will be the common measure ; by which divide both terms, for the fraction required or lowest term.

EXAMPLES.

1 Reduce $\frac{91}{117}$ to its lowest terms. Ans. $\frac{7}{9}$

91)117(1
91

26)91(3
78

13)26(2
26

Common measure

13)$\frac{91}{117}$($\frac{7}{9}$ Ans.

2 Reduce $\frac{144}{216}$ to its lowest terms. *Ans.* $\frac{2}{3}$

3 Reduce $\frac{30}{125}$ to its lowest terms. *Ans.* $\frac{6}{25}$

4 Reduce $\frac{48}{56}$ to its lowest terms. *Ans.* $\frac{6}{7}$

5 Reduce $\frac{144}{324}$ to its lowest terms. *Ans.* $\frac{1}{2}$

6 Reduce $\frac{216}{288}$ to its lowest terms. *Ans.* $\frac{3}{4}$

7 Reduce $\frac{308}{484}$ to its lowest terms. *Ans.* $\frac{63}{121}$

8 Reduce $\frac{42}{315}$ to its lowest terms. *Ans.* $\frac{1}{7}$

9 Reduce $\frac{324}{960}$ to its lowest terms. *Ans.* $\frac{55}{64}$

10 Reduce $\frac{144}{1728}$ to its lowest terms. *Ans.* $\frac{1}{12}$

CASE 2.

To reduce the value or quantity of a fraction to the known parts of an integer.

RULE.

Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

1 What is the value of $\frac{2}{3}$ of a pound sterling?

Numer. 2

20 shillings in a pound.

Denom. 3)40(13s. 4d. *Ans.*

3

10

9

1

12 pence in a shilling.

3)12(4d.

12

2 What is the value of $\frac{3}{4}$ of a pound sterling? *Ans.* 15s.

Reduce $\frac{2}{3}$ of a shilling to its proper quantity.

Ans. 4d. $\frac{2}{3}$

4 Reduce $\frac{2}{3}$ of a pound avoirdupois to its proper quantity.
Ans. 9oz. $2\frac{2}{3}$dr.

5 Reduce $\frac{7}{8}$ of an hundred weight to its proper quantity.
Ans. 3qrs. 3lb. 1oz. $12\frac{4}{5}$dr.

6 Reduce $\frac{3}{5}$ of a pound troy to its proper quantity.
Ans. 7oz. 4dwt.

7 Reduce $\frac{4}{5}$ of a mile to its proper quantity.
Ans. 6 fur. 16 poles.

8 Reduce $\frac{5}{8}$ of an acre to its proper quantity.
Ans. 2 roods, 20 po.

9 Reduce $\frac{6}{7}$ of a hogshead of wine to its proper quantity.
Ans. 54 gallons.

10 Reduce $\frac{3}{5}$ of a month to its proper quantity
Ans. 2wks. 2d. 19h. 12m.

SINGLE RULE OF THREE.

The Single Rule of Three teaches by three numbers given to find a fourth, in such proportion to the third, as the second is to the first, and is called the Rule of Three from its having three numbers given. Of the three given numbers, two are called the Terms of Supposition, and the other the Term of Demand.

RULE FOR STATING.

1 Place that term or number in the third place which is of the same name or kind with the answer: that is, if the answer is money, the third term must be money, or if the answer be weight or measure, then the third must be weight or measure.

2 Then consider, from the nature of the question, whether the answer is to be more or less than the third term. If more, set the greater of the two remaining terms in the second place, and the lesser in the first place: but if the answer is to be less than the third term, then set the less one in the second place, and the greater in the first place.

RULE FOR WORKING.

3 If the first and second terms be of different denominations, reduce them both to the lowest denomination in either.

4 If the third consist of several denominations reduce it to the lowest one mentioned.

5 Then multiply the second and third terms together, and divide by the first, and the quotient will be the fourth term,

or answer, in the same denomination as the third, or that to which the third was reduced.

PROOF.

Invert the question, making the answer the third term.

EXAMPLES.

NOTE. As this is a rule that is much used, and sometimes difficult for learners to comprehend, I shall explain one question at large.

1 What is the value of a silver tankard, weighing 1lb 8oz. 10dwt. 12grs at the rate of 6s. 8½d. per ounce?

In this example it is evident that the answer is to be money, I therefore place the 6s. 8½d. in the third place: thus,

---

The rule that is given above, as it renders the distinction of *direct* and *inverse* proportion unnecessary, and has several other advantages, is preferable to the one which was formerly used; and it is likely to be generally adopted; but, for the convenience of those teachers who have not yet determined to employ it, the last mentioned rule is subjoined.

DIRECT PROPORTION.

Direct Proportion is that wherein the third term is greater than the first, and requires the fourth term, or answer, to be greater than the second; or the third less than the first, and requires the fourth to be less than the second.

RULE FOR STATING.

1. Place that number in the third place which we want to find the value of.

2. That one which is of the same name with the third in the first place; or, in other words, *if the third term is money, the first must be money; if the third term is weight or measure, the first must be weight or measure, &c.*

3. And the remaining one in the second place which must be of the same name with the answer; *that is, if the answer is money, the middle must be money, &c.*

RULE FOR WORKING.

4. If the first and third terms be of different denominations, reduce them both to the lowest denomination in either.

5. And if the second consist of several denominations reduce it to the lowest one mentioned.

6. Then multiply the second and third terms together, and divide the product by the first, and the quotient will be the fourth term or answer, *in the* same denomination as the second, or that to which the second *was reduced.*

First term.		Second term.		Third term.
	:		::	6s. 8½d.

After having placed the third term with the dots as above, I examine the question, and find that the answer must be more than the third term; I then set the larger of the two remaining terms in the second place, and the less one in the first: thus,

oz.		lb.	oz.	dwt.	gr.		s.	d.
As 1	:	1	8	10	12	::	6	8½

I now examine my first and second terms, and find the lowest denomination mentioned to be grains; I accordingly reduce them both into grains; I then proceed to my second term and reduce that to farthings, because farthings is the lowest denomination: thus,

oz.		lb.	oz.	dwt.	gr.		s.	d.
As 1	:	1	8	10	12	::	6	8½
20		12					12	
20		20					80	
24		20					4	
480 grs.		410					322 farthings.	
		24						
		1652						
		820						
		9852 grs.						

EXAMPLE.

If 2 yards of Muslin cost 4 shillings, what will 8 yards cost?

	yds.	s.	yds.
If	2	: 4	:: 8
			4
			2)32
Ans.			16s.

The question is now prepared for the essential part of the rule. viz. Multiply the second and third terms together, and divide the product by the first.

9852 second term.
322 third term.

19704
19704
29556
(4)
First term 480)3172344(6609 Ans. in farthings.
2880
12)1652 ¼ pence.
2923
2880 2(0)13(7 : 8
4344 £6 17s. 8¼d. Ans.
4320
24
480

2 If 2 yards of muslin cost 4 shillings, what will 8 yards cost ? Ans. 16s.

	yds.		yds.		s.		s.		s.		yds.
As	2	:	8	::	4	As	16	:	4	::	8
			4								4
	2)32										16)32(2y. proof.
	16 Ans.										32

INVERSE PROPORTION.

Inverse proportion is that wherein the third term is greater than the first, and requires the fourth term or answer to be less than the second; or the third term less than the first, and requires the fourth to be greater than the second.

RULE.

After stating the sum as in Direct Proportion, then multiply the first and second terms together, and divide the product by the third term; the quotient will be the fourth term, or answer, as in Direct Proportion.

PROOF.

As in Direct Proportion.

3 What is the worth of 2cwt. 1qr. 12lb. sugar, when 1 lb. cost 10½d. Ans. 11*l.* 11s.

	lb		Cwt.	qr.	lb		d.
As	1	:	2	1	12	::	10½
			4				4
			9				42
			28				
			264				
			42				
			528				
			1056				

4)11088 farthings.

12)2772 pence.

2(0)23(1 shillings.

£11 11s. Ans.

4 If 4 yards of cloth cost 7 dols. what cost 20 yards ?
Ans. 35 dols.

5 If 1 lb. of cotton cost 15cts. what cost 12lb. ? Ans. $1 80c.

6 If 28lb. butter cost 5dols. 92cts. what cost 7lb. ?
Ans. $1 48cts.

7 If a cheese weighs 24lbs. what is the worth of it at 10cts. per lb. ? Ans. $2 40cts.

8 If 3yds. of cloth cost £5 what cost 81yds. *Ans.* £135

9 If 5lb. of sugar cost [illegible] what will 30lb. cost ?
Ans. £2 14s.

EXAMPLE.

If 48 men can build a wall in 24 days ; how many men can do the same in 192 days.

	Days.		men.		days.
If	24	:	48	::	192
			24		

192)1152(6 men, Ans.
1152

10 If 20 yards cost 120*l.* how many yards may I have for 30*l.* *Ans.* 5yds.

11 If 4s. buy 7lb. of sugar, how much will £2 12s. buy ? *Ans.* 91lb.

12 If 1 yard of cloth cost £1 8s. what will be the worth of 20 yards ? *Ans.* 28*l.*

13 If 12 yds. of cloth cost £1 16s. what cost 192 yards ? *Ans.* £28 16s.

14 If 16lb. of sugar cost £1 8s. what is the value of an cwt. ? *Ans.* £9 16s.

15 What will 9 yards of cambrick cost at the rate of 40 dols. 96cts. for 72 yards ? *Ans.* 5 dols. 12cts.

16 Bought an cwt. of sugar for 8 dols. 75cts. what is the value of 14lb. of said sugar ? *Ans.* 1dol. 9cts. 3m. +

17 If 1cwt. of sugar cost £5 12s. 9d. what will 8cwt. cost ? *Ans.* £45 2s.

18. At 15d. per lb. what is Loaf sugar per cwt. *Ans.* 7*l.*

19 If 1 lb. of cheese cost 10½d what is the worth of 1cwt. *Ans.* £4 18s.

20. If 9cwt. 3qrs. of sugar cost 50 dollars, what will 2cwt. 1 qr. 11 lb. cost ? *Ans.* $12 4cts.+

21. How many bushels of rye for 100*l.* at 6s. 6d. per bushel ? *Ans.* 307 bush. 2 pecks $\frac{60}{78}$

22. If 1 bushel of corn be sold for 4s. 9d. what will 24 bushels come to ? *Ans.* £5 14s.

23. Bought a firkin of butter, containing 56lb. for £3 14s. 8d. what is that per lb. Ans. £0 1s. 4d.

24. A merchant bought a lot of pork containing 16 hogs weighing together 3752lb. at $5 50cts. per hundred; what come they to ? *Ans.* $206 36cts.

25. Sold 156lb. of cheese at 7½cts. per pound ; what is the price of the whole ? *Ans.* $11 70cts.

26. If 360z. 10dwt. of silver be worth $24 35cts. ; how much is that per ounce ? *Ans.* 66cts. 6m.×

27. If 1 hogshead of molasses containing 103 gallons, cost £17 4s. 8d. ; what is it per gallon. *Ans.* 3s. 4d.+

28. If the price of 1 acre of land be $18 25cts. what will 50 acres, 2 roods, 20 perches come to ? *Ans.* $923 9 ½+

29. Bought 12 pieces of cloth, each 12 yards at $1 40cts. per yard ; what come they to ? *Ans.* $201 60cts.

30. If a man's yearly income be 300*l.* what is it per day ?
Ans. 16s. 5$\frac{1}{2}$d.+

31. If a man spend 7d. per day, how much is that in a year ?
Ans. £10 12s. 11d.

32. If 4$\frac{1}{2}$ tons of hay will keep 3 cattle over the winter, how many tons will it take to keep 25 cattle the same time ?
Ans. 37$\frac{1}{2}$ tons.

33. A man bought sheep at $1 11cts. per head, to the amount of $51 6cts.; how many sheep did he buy ?
Ans. 46.

34. If 3$\frac{1}{2}$lb. of cheese cost 1s. 1d. what cost 1cwt ?
Ans. £1 14s. 8d.

35. How much is tobacco an ounce, when 17cwt. 3qr. 17lb. sell for $320 80cts. *Ans.* 1ct.

36. When a bankrupt compounds with his creditors at 12s. 6d. in the £.; how much is the merchant's part to whom he owes 1000*l.* Ans. 625£.

37. A merchant failing in trade, owes in all 29475 dolls. and delivers up his whole property, worth $21894 3cts.; how much does he pay on a dollar ? Ans. 74cts. 2m.+

38. What will be the value of 1475 bushels of Indian corn, at 87$\frac{1}{2}$cts. a bushel ? Ans. $1290 62$\frac{1}{2}$cts.

39. What does the carriage of 10cwt, 2qrs. come to at 1$\frac{1}{2}$d. per pound ? Ans. £7 7s.

40. If a pint of wine cost 10d. what cost 3hhds.
Ans. 63*l.*

41. If a pipe of Canary cost 40*l.*; how much is that per pint ? *Ans.* 9d. 2qrs. $\frac{96}{1007}$

42. If a person's income be $890 15cts. a year, how much may he spend each day, to save at the year's end 120 dolls. ?
Ans. $2 11cts.

43 If a man's annual income be 1333 dollars, and he expends daily $2 14cts.; how much will he save at the year's end ? *Ans.* $551 90cts.

44. Bought 3 pipes of wine containing 120$\frac{1}{2}$, 124, 126$\frac{3}{4}$ gallons, at 5s. 6d. per gallon ; what come they to ?
Ans. £102 1s. 10$\frac{1}{2}$d.

45. What must be paid for 53 ells English, 1qr. of Holland at the rate of 7s. 9$\frac{1}{2}$d. per yard ? *Ans.* £25 18s. 1$\frac{1}{4}$d.

46. If a yard of broadcloth costs 18s. what cost 5 pieces, each 20 yards ? *Ans.* £90.

47. What will be the value of a farm containing 225 acres at £18 16s. an acre ? *Ans.* £4230.

48. What will the tax upon $1786 67cts. be, at the rate of 12cts. per dollar? *Ans.* $214 40cts.

49. What is the value of a silver tankard weighing 11lb. 7oz. 4dwt. at 6s. 4d. per oz. *Ans.* £6 4s. 9×

50. A draper bought 6 packs of cloth, each containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and gave after the rate of £4 16s. for 6 yards; I desire to know what the 8 packs stood him in? *Ans.* 6656*l.*

51. If a staff 4 feet long, cast a shade (on level ground) 7 feet long, what is the height of a steeple, whose shade, at the same time, is 198 feet? *Ans.* 113×feet.

52. The earth being 360 degrees in circumference, turns round on its axis in 24 hours; how far are the inhabitants at the equator carried in one minute, a degree there being 69½ miles? *Ans.* 17m. 3fur.

INVERSE PROPORTION.

Questions in Inverse Proportion, may be solved precisely in the same manner as in the foregoing examples.

EXAMPLES.

1. If 12 men can build a house in 48 days, in what time could 36 men build it? *Ans.* 16 days.

2. If 160 poles long and 1 pole wide make an acre, how much in length, that is 8 poles wide, must be taken to contain an acre? *Ans.* 20 poles.

3. How many labourers must be employed to finish a piece of work in 15 days, which 5 can do in 24 days. *Ans.* 8 men.

4. If a man perform a journey in 6 days, when the day is 8 hours long, in what time will he do it when the day is 12 hours long? *Ans.* 4 days.

5. If I lend my friend 100*l.* for 180 days, how long ought he to lend me 450*l.* to return my kindness? *Ans.* 40 days.

6. How many yards of matting 2 feet 6 inches broad, will cover a floor that is 27 feet long and 20 feet broad? *Ans.* 72yds.

7 If a board be 9 inches broad, what length will it require to measure 12 feet square? *Ans.* 16 feet.

8. What quantity of shalloon, that is 3 quarters of a yard wide, will line 7⅓ yards of cloth, that is 1½ yard wide? *Ans.* 15 yards.

9. If when wheat is 83 cents per bushel, the cent loaf

weighs 9oz. what ought it to weigh, when wheat is at $1 24 cents, 5 mills per bushel? *Ans.* 6oz.

10. There is a cistern having a pipe which will empty it in 15 hours; how many pipes of the same capacity will empty it in 3 quarters of an hour? Ans. 20 pipes.

11. How many yards of carpeting, that is 3 quarters of a yard wide, are sufficient to cover a floor that is 18 feet wide and 60 feet long? Ans. 160 yards.

12. What is the weight of a pea to a steelyard which being suspended 39 inches from the centre of motion, will equipoise 208 lb. suspended at the draught end 3 quarters of an inch? Ans. 4 lb.

PROMISCUOUS EXAMPLES IN DIRECT AND INVERSE PROPORTION.

1. If 17 tons, 12 cwt. of iron cost 880 dollars, what is that for two Cwt.? Ans. 5 dollars.

2. What cost 49392 case knives, at 4s. 4d. per dozen? Ans. 891*l.* 16s.

3. If an ingot of gold weighing 9lb. 9oz. 12dwt. be worth £411 12s. what is that per grain? Ans. 1¾d.

4 A borrowed of B $250 for 7 months; and in return lends him 300 dollars: How long ought B to keep it, that the interest of it may be equal to that of the first sum? Ans. 5mo. 25 days.

5 The rents of a parish amount to £3500, and a rate is granted of £131 5s. how much is that on a pound? Ans 9d.

6 Bought 27¼ yards of muslin at 6s. 9½d. per yard, what does it amount to? Ans. £9 5s. 0¾d.+

7 How much in length, that is 4½ inches broad, will make a foot square? Ans. 32 inches.

8 If 1cwt. of sugar cost 13dols. 50cts. what must be paid for 17 cwt. 3 qr. 14 lb.? Ans. $241 31cts. +

9 If 12 pears are worth 21 apples, and 3 apples cost a cent, what will be the price of fourscore and four pears? Ans. 49 cents.

10 If the Legislature of a state grant a tax of 8 mills on the dollar, how much must a man pay who is 319 dols. 75 cts. on the list? Ans. $2 55cts. 8m.

11 If 40 poles in length and 4 in breadth, make an acre, what must be the length to make an acre, when the breadth is 15 poles? *Ans* 10 poles, 5 yds. 2ft.

12 *A drover having* bought 64 fat oxen at 50dols. a head,

expense of driving to market is 20dols. for butchering 33dols. 33 cents, of salt 26dols. 67 cents, of barrels and storage 50dols. and he would gain 654dols. on the whole, what will be the price of 27 of said oxen in barrels? *Ans.* $1680 75cts.

13 A man bought a piece of cloth for 16*l.* 10s. at 15s. per yard, how many yards did it contain? *Ans.* 22yds.

14 A owes B 596*l.* 6s. 8d. but failing in trade, he is able to pay but 15s. 6d. on the pound, how much is B to receive and what is his loss? *Ans.* he is to receive 462*l.* 3s. 2d. his loss is 134*l.* 3s. 6d.

15. I saw the flash of a gun, and heard the report one minute and three seconds afterwards; how far was I from the gun? *Ans.* 13 miles, 5fur. 170yds.

NOTE—Sound, if not interrupted, moves 1150 feet in one second.

PRACTICE.

Practice is a short method of ascertaining the value of any quantity of goods, by the given price of an integer.

PROOF.

Practice may be proved by varying the parts; by compound multiplication; or by the single rule of three.

TABLES OF ALIQUOT PARTS.*

Of a pound.			Of a shilling.			Of a dollar.			Of a Cwt.		
s.	d.	£	d.		s.	cts.		$	lb		cwt.
10	0 is	$\frac{1}{2}$	6	is	$\frac{1}{2}$	50	is	$\frac{1}{2}$	56	is	$\frac{1}{2}$
6	8 :	$\frac{1}{3}$	4	:	$\frac{1}{3}$	25	:	$\frac{1}{4}$	28	:	$\frac{1}{4}$
5	0 :	$\frac{1}{4}$	3	:	$\frac{1}{4}$	20	:	$\frac{1}{5}$	16	:	$\frac{1}{7}$
4	0 :	$\frac{1}{5}$	2	:	$\frac{1}{6}$	$12\frac{1}{2}$	:	$\frac{1}{8}$	14	:	$\frac{1}{8}$
3	4 :	$\frac{1}{6}$	$1\frac{1}{2}$	:	$\frac{1}{8}$	10	:	$\frac{1}{10}$	8	:	$\frac{1}{14}$
2	6 :	$\frac{1}{8}$	1	:	$\frac{1}{12}$	$6\frac{1}{4}$	:	$\frac{1}{16}$	7	:	$\frac{1}{16}$
2	0 :	$\frac{1}{10}$	Of a penny.								
1	8 :	$\frac{1}{12}$	qr.		d.						
			1	:	$\frac{1}{4}$						
			2	:	$\frac{1}{2}$						

CASE 1.

When the price of an integer, (or the price of one yard, one gallon, &c.) is less than a penny.

* Aliquot part or parts of a number or quantity, are such as will exactly measure or divide it without a remainder; thus, 3 is an aliquot part of 12, and 7 of 21, &c.

RULE.

If the price of a farthing or a half-penny, divide the given number by as many thereof as make a penny, for the answer in pence.

If the price be three farthings, find the value of the given number at a half-penny, and afterwards at a farthing; then add the two results together, and their amount will be the answer in pence.

NOTE—When remainders occur, proceed with them as under case 3, in Compound Divison.

EXAMPLES.

1. What is the value of 4528 quills, at $\frac{1}{4}$ each?
2. What is the value of 4528 eggs, at $\frac{3}{4}$ each?

(1)

$\frac{1}{4}$ | $\frac{1}{4}$ | 4528

12)1132 Ans. in pence.

2(0)9(4 4

Ans. £4 14 4

(2)

$\frac{1}{2}$ | $\frac{1}{2}$ | 4528

$\frac{1}{4}$ | $\frac{1}{2}$ | 2264 value at $\frac{1}{2}$
1132 value at $\frac{1}{4}$

12)3396

2(0)28(3

Ans. £14 3s.

3	5704	at	$\frac{3}{4}$	Ans.	5	18 10
4	7612	at	$\frac{1}{2}$		7	18 7
5	6813	at	$\frac{1}{4}$		14	3 $10\frac{1}{2}$
6	7672	at	$\frac{1}{2}$		15	19 8
7	9424	at	$\frac{3}{4}$		29	9 0
8	1487	at	$\frac{3}{4}$		4	12 $11\frac{1}{4}$

CASE 2.

When the given price is a penny, or more than a penny, but less than a shilling.

RULE.

Separate the price into parts, one of which shall be an aliquot part of a shilling, and the other, either aliquot parts of this part, or of a shilling, or of one another; find the value of

the given number of one or more of such parts of the price, as are aliquot parts of a shilling; then, from the value at these parts, find the value at the rest of the price, and add the several sums together for the answer.

EXAMPLES.

1 What is the value of 6192 yards of tape at 3d per yard?

3 | ¼ | 6192 at 3d.

2(0)154(8 value in shillings.

77 8

2 What is the value of 3711 lb of cheese at 7¾ per lb.

4 | ¼ | 3711 at 7¾

3 | ¼ | 1237 at 4
½ | ⅛ | 927 9 at 3
¼ | 1/16 | 154 7½ at ¼
 | ¼ | 77 3¾ at ¼

2(0)239(6 8¼

£119 16 8¼ Ans.

		d.		£.	s.	d.
2	1861 at	2	Ans.	15	10	2
3	2147 at	3½		31	6	2½
4	7000 at	3¾		109	7	6
5	3257 at	4		54	5	8
6	2456 at	4½		43	9	10
7	3210 at	5		66	17	6
8	7521 at	5¾		180	3	9¾
9	7610 at	6¼		198	3	6¼
10	3271 at	7		95	8	1
11	3714 at	7¾		119	18	7½
12	2759 at	8½		97	14	3½
13	5272 at	9		197	14	0
14	6825 at	9¼		243	15	6¼
15	3254 at	10½		142	7	3
16	3256 at	11		149	4	8
17	7972 at	11¾		390	5	11

CASE 3.

When the given price is more than one shilling and less than two.

RULE.

Let the given quantity or number stand for so many shillings, to which add the amount in shillings of said quantity at the overplus price found by case 1 or 2 for the answer in shillings.

EXAMPLES.

1 At $12\frac{1}{4}$d per lb. what will 468 lb. amount to ?

| $\frac{1}{4}$ | $\frac{1}{4}$ | 468

12)117 pence

9 : 9

2(0)47(7 : 9

£23 : 17 : 9 Ans.

2 What is the value of 725 yards at $13\frac{1}{8}$d. per yard ?

| $1\frac{1}{8}$ | $\frac{1}{8}$ | 725

90 : $7\frac{1}{2}$

2(0)81(5 : $7\frac{1}{2}$ shillings.

£40 15 $7\frac{1}{2}$ Ans.

		d.		£	s.	d.
3	6100 at	$13\frac{1}{2}$	Ans.	343	2	6
4	1210 at	$13\frac{3}{4}$		69	6	$5\frac{1}{2}$
5	1479 at	15		92	8	9
6	5271 at	$15\frac{1}{2}$		340	8	$4\frac{1}{2}$
7	7121 at	$16\frac{1}{4}$		482	3	$9\frac{1}{2}$
8	4128 at	17		292	8	0
9	7890 at	$18\frac{3}{4}$		615	8	$1\frac{1}{2}$
10	9876 at	$19\frac{1}{2}$		802	8	6
11	7120 at	$20\frac{1}{4}$		600	15	0
12	4321 at	21		378	1	9
13	9010 at	$22\frac{1}{4}$		835	6	$0\frac{1}{2}$
14	6812 at	$23\frac{3}{4}$		674	2	1

CASE 4.

When the price is any number of shillings under 20.

RULE.

Multiply the quantity by the price for the answer in shillings: or,

If the price be even shillings, multiply by half the price, and double the right hand figure of the product for shillings, the rest of the product will be pounds; or,

If the price be an aliquot part of a pound, divide the given number by as many thereof as make a pound for the answer in pounds.

EXAMPLES.

1 What is the value of 527 bushels of corn at 4s. per bushel? Ans. £105 8s.

527	527	4 | ⅕ | 527
4	2	
2(0)210(8	£105 8	£105 8
£105 8		

			s.		£	s.	d.
2	121	at	3	Ans.	18	3	0
3	3254	at	4		650	16	0
4	3271	at	5		817	15	0
5	2710	at	6		813	0	0
6	2715	at	7		950	5	0
7	191	at	8		76	8	0
8	3214	at	9		1446	6	0
9	121	at	11		66	11	0
10	600	at	13		390	0	0
11	2150	at	15		1612	10	0
12	1075	at	16		860	0	0
13	121	at	17		102	17	0
14	2150	at	19		2042	10	0

CASE 5.

When the price is shillings and pence; or shillings, pence, *and farthings.*

RULE.

If the price be shillings and pence, and they the aliquot part of a pound, divide the given number by as many thereof as make a pound, for the answer in pounds; but

If the price be not an aliquot part of a pound, then multiply the quantity by the shillings, and take parts of the rest, agreeably to Case 1 or 2 and add them together, and their sum will be the answer in shillings.

EXAMPLES.

1 What will 2710 bushels of corn come to at 6s. 8d. per bushel?

s.	d.		
6	8	$\frac{1}{3}$	2710

£903 6 8

2 What will 246 yards velvet come to, at 7s. 3d. per yard?

3	$\frac{1}{4}$	246
		7

1722 value at 7s. per yard.
61 6 value at 3d.

2(0)178(3 6

Ans. £89 3 6

		s.	d.		£	s.	d.
3	378 at	1	8	*Ans.*	31	10	0
4	324 at	2	6		40	10	0
5	126 at	3	4		21	0	0
6	624 at	6	8		208	0	0
7	3271 at	5	$9\frac{1}{2}$		947	4	$6\frac{1}{2}$
8	3715 at	9	$4\frac{1}{2}$		1741	8	$1\frac{1}{2}$
9	2103 at	15	$7\frac{1}{2}$		1642	19	$4\frac{1}{2}$
10	7152 at	17	$6\frac{1}{2}$		6280	7	0
11	1924 at	19	6		1875	18	0

CASE 6.

When the price is pounds, or pounds, shillings, &c.

RULE.

Multiply the given quantity by the pounds, and take parts for the shillings, &c. or,

Reduce the pounds and shillings into shillings; and multiply the given quantity by the said shillings; take parts with the rest of the price, and add them together as before, and the sum will be shillings.

EXAMPLES.

1. 124 tons at £3 5s. $6\frac{1}{2}$. per ton.

5	$\frac{1}{2}$	124
		3
d		372
6	$\frac{1}{10}$	31
$\frac{1}{2}$	$\frac{1}{12}$	3 2
		0 5 2
		£406 7 2

Or thus

6	$\frac{1}{2}$	124
		65 = £3 5s.
		620
		744
$\frac{1}{2}$	$\frac{1}{12}$	62
		5 2

£2(0)812(7 2

406 7 2

			£.	s.	d.		£	s.	d.
2	47	at	3	3	4	Ans.	148	16	8
3	20	at	4	13	4		93	6	8
4	26	at	11	14	0		304	4	0
5	71	at	6	13	4		473	6	8
6	37	at	1	19	$5\frac{1}{4}$		73	0	$8\frac{1}{4}$
7	457	at	14	17	$9\frac{1}{2}$		6804	10	$9\frac{1}{2}$
8	2150	at	17	16	$1\frac{1}{2}$		38283	8	9

CASE 7.

When both the price of an integer, and the quantity, are of divers denominations.

RULE.

Multiply the price by the numbers of the highest denomination, and take parts of the price for the remaining denominations and add them together.

EXAMPLES.

1 What is the value of 21 cwt. 3 qrs. 25 lb at £2 3s. 4d. per cwt.

qr.		£.	s.	d.	
2	½	2	3	4	
				7+3=21	
		15	3	4	price of 7 cwt.
				3	
		45	10	9	price of 21 cwt.
1	½	1	1	8	
16 lb	¼		10	10	
8	⅛		6	2½	
1	1/28		3	1	
				4⅛	

Ans. £47 12 1⅝d.

	C. qr. lb.	£ s. d.	£ s. d.
2	12 2 14 of tobacco at	3 14 0 per C.	*Ans.* 46 14 3
3	25 3 14 of sugar at	3 17 6 per C.	100 5 3⅜
4	17 1 17 of tallow at	1 4 9 per C.	21 10 8
5	10 0 12 of tobacco at	1 19 6 per C.	19 19 2¼
6	5 1 0 of sugar at	2 17 0 per C.	14 19 3
7	7 0 19 of tallow at	3 16 0 per C.	27 4 10½
8	7 1 14 of tobacco at	3 15 9½ per C.	27 18 9½
	lb oz.	s. d.	
9	24 6 Troy at	8 9 per lb.	10 14 4½
10	27 10 at	1 4 per lb.	1 17 1¼
	Yds. qr.		
11	121 2 at	5 9 per yd.	34 18 7½
12	68 1 at	8 1 per yd.	27 11 8¼
	A. r. p.		
13	240 1 10 at	16 4 per acre	196 5 1¼

APPLICATION.

1 What is the value of 120 lb. of rice, at 3d. per lb.
Ans. 1*l.* 10s.

2 Bought 8012 lb. of chalk at 2¼d. per lb.? Ans. 91*l.* 16s. 1d.

3 How much will 3906 lb. of beef come to, at 7½ per lb.?
Ans. 122*l.* 1s. 3d.

4 What will 1847 yards of cloth come to at 5s. 8d. per yard?
Ans. 523*l.* 6s. 4d.

5 If an ell of Holland cost 4s. 6d. what is the value of 5 pieces, each 12 ells? *Ans.* 13*l.* 10s.

6 What is the value of 1234 yards of muslin at 1s. 11¼d. per yard? *Ans.* 122*l.* 2s. 3½d.

7 What cost 287 bushels of wheat at 17s. 6d. per bushel? *Ans.* 251*l.* 2s. 6d.

8 How much will 47 tons of hay amount to at 6*l.* 6s. 8d. per ton? *Ans.* 297*l.* 13s. 4d.

9 Sold 26 acres of land for 11*l.* 14s. per acre, what is the amount? *Ans.* 304*l.* 4s.

10 If 1 yard of cloth cost 1*l.* 19s. 4d. how much will 1677 yards come to? Ans. 3293*l.* 2s.

11 Sold 16cwt. 2qr. 17lb. of sugar, at 2*l.* 15s. 11d. per cwt. what was its value? *Ans.* 46*l.* 11s. 1d.

12 Sold 83yds. 2qrs. of superfine cloth at 3*l.* 4s. per yard; how much does it amount to? *Ans.* 267*l.* 4s.

13 If 1 acre of land be worth 11*l.* 15s. what is the value of 578 acres 3 roods? *Ans.* 6800*l.* 6s. 3d.

TARE AND TRET.

Tare and Tret are allowances made to the buyer, on some particular commodities.

Tare is the weight of the barrel, box, bag, or whatever contains the articles or goods.

Tret is an allowance of 4 lb. in every 104 lb. for waste, dust, &c.

Gross is the weight of the goods, together with the barrel, box, bag, or whatever contains them.

When the tare is deducted from the gross it leaves what is sometimes called the Suttle.

Neat is the weight of the goods, after all allowances are deducted.

CASE 1.

When the tare is so much in the whole gross weight.

RULE.

Subtract the tare from the gross, the remainder will be neat.

EXAMPLES.

1. What is the neat weight of 14 hogsheads of tobacco, weighing together 456cwt. 1qr. 19lb. tare, in the whole 15cwt. 2qr. 13lb.

	Cwt.	qr.	lb.	
	456	1	19	gross.
	15	2	13	tare.
Ans.	440	3	6	neat.

2. What is the neat weight of 24 hogsheads of tobacco, each weighing 6cwt. 2qr. 17lb. gross, tare in the whole 17cwt. 3qr. 27lb.

	Cwt.	qr.	lb.	
	6	2	17	
				4×6=24
	26	2	12	
			6	
	159	2	16	gross.
	17	3	27	tare.
Ans.	141	2	17	neat

3 What is the neat weight of 99cwt. 3qr. 18lb. gross, tare 2cwt. 3qr. 20lb. ? Ans. 96cwt. 3qr. 26lb.

4 What is the neat weight of 18 hogsheads of tobacco, each weighing 7cwt. 3qr. 16lb. gross, tare in the whole 14 cwt. 1qr. 21 lb. ? Ans. 127cwt. 2qr. 15lb.

5 What is the neat weight of 4 casks of indigo, the gross weight of each being 4cwt. 2qrs. 14 lb.; the tare in the whole 1cwt. 0qrs. 26lb. ? Ans. 17cwt. 1qr. 2 lb.

6 What is the neat weight of 4 casks of sugar, the gross weight and tare as follows :

	Cwt.	qrs.	lb.		qr.	lb.
No. 1	4	1	10	Tare	1	8
2	3	3	2		1	1
3	4	0	19		1	4
4	4	0	0		1	7

Ans. 15cwt. 0qr. 11 lb.

CASE 2.

When the tare is so much per barrel, box, bag, &c.

RULE.

Multiply the number of barrels, boxes, &c. by the tare per barrel, box, &c. subtract the product from the gross, and the remainder will be the neat.

EXAMPLES.

1 What is the neat weight of 30 casks of rice, each weighing 2cwt. 3qr. 12lb. gross, tare 21 lb. per cask; and what is the amount at $7 35cts. per cwt. ?

Ans. { Neat wt. 80cwt. 0qr. 10lb.
Value $588 65cts. 6m.+

Cwt.	qr.	lb.	
2	3	12	
		5×6=30	
14	1	4	
		6	
85	2	24	gross.
5	2	14	tare.
80	0	10	neat.

lb.	
21	
30	
4	
28)630(22	
56	
70	5C. 2 14
56	
14	

lb.		Dol.	cts.
8	1/14	7	35
		8×10=80	
		58	80
			10
		588	00
2	1/4		52 5
			13 1
		$588	65 6+

2 What is the neat weight of 8 hogsheads of tobacco, *weighing gross* 80cwt. 2qrs. 24 lb. tare 100lb. per hhd.

Ans. 79 cwt. 2 qr. 8 lb.

3 Sold 9 hogsheads of sugar, each 6cwt. 2qr. 12lb. gross, tare 86lb. per hhd. at $9 75cts. per cwt. what is the neat weight and value?

Ans. { 52cwt. 2qr. 6lb.
{ $512 39cts. 7m.

4 What is the neat weight and value of 12 casks of raisins, each weighing 3cwt. 2qr. 10 lb. gross, tare 20 lb. per cask, at 2*l.* 14*s.* per cwt.?

Ans. { 40cwt. 3qr. 20 lb.
{ 110*l.* 10*s.* 1½*d.*

CASE 3.

When the Tare is so much per hundred weight.

RULE.

Deduct from the gross such aliquot part or parts of it, as the Tare is of an Cwt. the remainder will be the neat. Or, multiply the pounds gross by the Tare per Cwt. and divide the product by 112; the quotient will be the Tare, which deduct as before.

EXAMPLES.

1 In 12 butts of currants, each 7cwt. 1qr. 10lb. tare 16lb. per cwt. how much neat; and what does it come to at 3*l.* 7*s.* 4d. per cwt.?

Ans. { 75cwt. 1qr. 27 lb.
{ 254*l.* 3*s.*

Cwt.	qr.	lb.				
7	1	10				
		12				
16 | ¼ | 88	0	8 gross.				
12	2	9 tare.				
75	1	27				

qr.		£	s.	d.
1	¾	3	7	4×3
				8×9+3=75
		26	18	8×
				9
		242	8	0
		10	2	0
lb.		0	16	10
16	1/7		9	7⅛
8	¼		4	9½
2	⅛		1	2¼
1	1/16		0	7
		£254	3	0 Ans.

2 What is the neat weight of 9 hhds. of Tobacco, each weighing gross 8cwt. 3qrs. 14lb. tare 16lb. per cwt. ?

Ans. 68cwt. 1qr. 24 lb.

3 In 83 cwt. 3 qrs. gross, tare 20 lb. per cwt. what is the neat weight ? *Ans.* 68cwt. 3qrs. 5lb.

4 What is the neat weight and value of 40 kegs of figs, gross 75cwt. 3qr. 14lb. tare 14lb. per cwt. at 18s. 6d. per cwt. ?

Ans. { Wt. 66cwt. 1qr. 16lb. / Value, 61*l.* 8s. 3d.

CASE 4.

When tret is allowed with tare.

RULE.

1 Find the tare as before directed, which subtract from the gross, and call the remainder suttle.

2 Divide the suttle by 26,* and the quotient will be the tret, which subtract from the suttle, and the remainder will be the neat weight.

EXAMPLES.

1 In a hogshead of sugar, weighing 10cwt. 1qr. 12lb. gross, tare 14lb. per cwt. tret 4lb. per 104lb. how much neat weight ?

Ans. 8cwt. 2qr. 24lb.

Cwt. qr. lb.
10 1 12
4
—
41
28
—
330
83
—

14 | 1/3 | 1160 gross,
145 tare.

26)1015(39
78
—
235
234
—
1

or thus,

Cwt. qr. lb.

14 | 1/3 | 10 1 12 gross.
1 1 5 tare.

26)9 0 7 suttle.
1 11

Ans. Cwt. 8 2 24 neat.

1015 suttle.
39 tret.

Ans. 976 lb. neat.

NOTE.—*The reason of dividing by 26 is to shorten the operation of multiplying by* 4 and dividing by 104, for 104 ÷ 4 = 26.

2 In 27 bags of coffee, each 2cwt. 3qrs. 17lb. gross, tare 13lb. per cwt. tret 4lb. per 104lb. what is the neat weight?

Ans. 66cwt. 2qr. 11lb.

Cwt.	qr.	lb.		gross.		tare.
2	3	17	= 325 + 27 =	8775	+ 13 ÷ 112 =	1018;

suttle.		tret.
8775 — 1018 = 7757 ÷ 26 =	298;	— 7757 — 298 =

7459lb. = 66cwt. 2qr. 11lb. Ans.

3 What is the neat weight of 17 chests of sugar, weighing 120cwt. 2qrs. gross; tare 176lb. tret. 4 lb. per 104lb.?

Ans. 12808lb. or 114cwt. 1qr. 12lb.

4 Sold 177cwt. 22lb. gross; tare 9lb. per cwt.; tret 4lb. per 104 lb.; required the neat weight, and its amount at £3 14s. per cwt.

Ans. { Wt. 156cwt. 2qr. 22lb.
Value £579 15s. 6½d. +

APPLICATION.

1 In 16 hogsheads of Tobacco, each weighing 5cwt. 1qr. 19lb. gross tare per hhd. 100lb.; how much neat weight?

Ans. 72cwt. 1qr. 20lb.

2 In 8cwt. 3qrs. 20lb. gross; tare 38lb. tret 4lb. per 104lb. how much neat weight? Ans. 925lb. neat.

3 In 14 hogsheads of tobacco, weighing gross 89cwt. 3qrs. 17lb.; tare per hogshead, 100lb.: what is the neat weight and value at $4 75cts. per cwt.?

Ans. { Wt. 77cwt. 1qr. 17lb.
Value, $367 65cts. 7m. +

4 What is the neat weight of 5 casks of sugar, weighing as follows; viz. No. 1, 4cwt. 2qr. 14lb. gross, tare 21 lb.; No. 2, 3cwt. 0qr. 17lb. gross, tare 18lb.; No. 3, 5cwt. 3qr. 10lb. gross, tare 1 qr. 11 lb.: No. 4, 6cwt. 1qr. 16lb. gross, tare 27lb.; No. 5, 3cwt. 2qr. 18lb. gross, tare 19lb.: and what is the value, the three first at 2*l.* 4s. 7d. per Cwt. and the other two at 2*l.* 17s. 6d.

Ans. { Wt. 22cwt. 2qr. 7lb.
Value £56 10s. 5½d. +

5 Sold 12 butts of currants, at $9 20cts. each, butt weighing 7cwt. 1qr. 10lb. gross; tare 15lb. per cwt. what is the neat weight and amount.

Ans. { Wt. 75cwt. 1qr. 27lb.
Value, $694 51cts. 1m. +

THE DOUBLE RULE OF THREE.

The Double Rule of Three is that, wherein five numbers or terms are given, to find a sixth; three of which are a supposition, and two a demand.

RULE.

1 Place that number or term which is of the same name or kind with the answer in the third place.

2 Then take one term from the supposition, and one from the demand, both of the same name or kind, and place them with the third term, as directed in the Single Rule of Three.

3 Then proceed in the same manner with the two remaining terms.

4 Reduce the similar terms to the same denomination if necessary.

5 Multiply the terms in the second and third place together, and divide the product by the product of those in the first place: the quotient will be the answer or term sought.

The above rule is preferred for similar reasons to those which have been given for adopting the new rule in Single Rule of Three. The one formerly used is however subjoined.

RULE.

1. Set the two terms of the supposition, which are like those of the demand, one under the other in the first place.

2. That one which is the same kind as the answer in the second.

3. And the two demanding terms in the third place.

4. The correspondent terms of the supposition and demand must be placed opposite to each other, and of the same denomination as in the following examples.

If 4 men in 6 days eat 12lbs. of bread, how much will 6 men consume in 16 days.

If 4m. { 1lb. } 6m.
6d. { 12 } 16d.

If 4 men eat 12lb. of bread in 6 days, in how many days will 6 men consume 48 lb. ?

If 4m. { days. } 6m.
12lb. { 6 } 48lb.

To know whether the statement be direct or inverse; consider the two upper terms with the middle one, as a stating in the Single Rule of Three, and then the lower terms in like manner; if both statements be direct, then the question is in direct proportion; but if either of the statements be inverse, then the question is inverse: therefore, the first question above is direct, and the second inverse.

PROOF.

By two statings of the rule of three : Or, invert the stating.

NOTE.—If either of the first terms, or both, will divide any of the three last, or can be divided by any of them, or by any other number without a remainder, the operation may be contracted by cancelling them, and using their quotients in their stead.

EXAMPLES.

1. If 6 men in 8 days, eat 10 lbs. of bread, how much will 12 men eat in 24 days? *Ans.* 60 lb.

men 6 : 12 }
days 8 : 24 } : : 10lb.

288
10

48)2880(60 *Ans.*
288

0

Contracted.

6, : 12, 2 }
8, : 24, 3 } : : 10lb.

6
10

60 *Ans.*

2. Suppose 4 men in 12 days mow 48 acres; how many acres can 8 men mow in 16 days? *Ans.* 128 acres.

3. If 10 bushels of oats be sufficient for 18 horses 20 days, how many bushels will serve 60 horses 36 days?

Ans. 60 bushels.

4. If 8 men have $7 68cts. for 4 days work, how much ought 48 men to receive for 16 days? *Ans.* $184 32cts.

5. If 7 quarters of malt are sufficient for a family of 7 persons 4 months, how many quarters will 46 persons use in 10 months? *Ans.* 115 quarters.

6. If 8 men have 3*l.* 4s. for 4 days work, how much ought 48 men to receive for 6 days? *Ans.* 28*l.* 16s.

7. If 100*l.* in 12 months gain 6*l.* interest, how much will 75*l.* gain in 9 months? *Ans.* 3*l.* 7s. 6d.

DIRECT PROPORTION.

RULE.

Multiply the two terms in the third place, together and that product by the middle term; divide this product by the product of the terms in the first place, and the quotient will be the answer, in the same denomination as the middle term.

8. If 100*l.* in 52 weeks gain 6*l.* interest, how much will 60*l.* gain in 26 weeks? *Ans.* 3*l.*

9. Suppose the wages of 6 persons for 21 weeks be $288 what will be the hire of 14 persons for 46 wks.? *Ans.* $1472

10. An usurer put out $186 to receive interest for the same, and when it had continued 8 months, he received for principal and interest $193 44cts.; I demand at what rate per cent. per annum, he received interest? *Ans.* 6 per cent.

11. If the carriage of 8cwt. 128 miles, cost $12 80 cents, what must be paid for the carriage of 4cwt. 32 miles? *Ans.* $1 60cts.

12. If 2 men can do 12 rods of ditching in 6 days, how many rods may be done by 8 men in 24 days? *Ans.* 192 rods.

13. If 16*l.* 18s. be the wages of 16 men for 8 days, what sum will 32 men earn in 24 days? *Ans.* 101*l.* 8s.

14. If 3 masters, who have each 8 apprentices, in 5 weeks, each week 6 days, earn 360 dollars; how much will 5 masters who have each 10 apprentices, earn in 8 weeks, each week $5\frac{1}{2}$ days, their daily wages being the same? *Ans.* 1100 dolls.

INVERSE PROPORTION.

1. If 4 dollars be the hire of 8 men for 3 days, how many days must 20 men work for 40 dollars? *Ans.* 12 days.

2. If 4 men have 24 shillings for 3 days work, how many men will earn 4*l.* 16s. in 16 days? *Ans.* 3 men.

3. If 100*l.* in 12 months gain 7*l.* interest, what principal will gain 3*l.* 18s. 9d. in 9 months? *Ans.* 75*l.*

EXAMPLE.

1 If 6 men in 8 days eat 10lb. of bread, how much will 12 men eat in 24 days? Ans. 60lb.

6 men, 8 days } 10lb. { 12 men, 24 days

48 — 288

10

48)2880(60 Ans.
288
0

Cancelled

6,m / 8,d } 10 { 12,m.(2 / 24,d(3

6

10

Ans. 60

4. If 200 lb. be carried 40 miles for 40 cents, how far may 20200 lb. be carried for $60 60cts. ? *Ans.* 60 miles.

5. If a footman travel 240 miles in 12 days, when the days are 12 hours long, how many days will he require to travel 720 miles when the days are 16 hours long ? *Ans.* 27 days.

6. If 100*l.* in 12 months gain 8*l.* interest, what sum will gain 8*l.* 12s. in 5 months ? *Ans.* 258*l.*

APPLICATION.

1 If 4 men in 5 days eat 7 lb. of bread, how much will be sufficient for 10 men 15 days ? *Ans.* 84 lb.

2 If 360 lb. of beef serve 340 men 15 days, how many lbs. will serve 130 men 25 days ? *Ans.* $229\frac{7}{17}$ lbs.

3 If 100 dolls. in one year gain 3½ dolls. interest ; what sum will gain 38 dolls. 50 cts. in one year and a quarter ? *Ans.* 880 dolls.

4 If the tuition of 3 boys for two quarters of a year be $40 20cts. how much will the tuition of 60 boys amount to, for 4½ years ? Ans. 7236 dolls.

5 If 145 men can make a wall 32 feet high, and 40 feet long, in 8 days, in how many days can 68 men build a wall 28 feet high of the same length ? Ans. 14 days, 22hrs.+

INVERSE PROPORTION.

RULE.

Transpose the inverse extremes ; that is, set that of the first place under the third, and that in the third under the first ; then work as in Direct Proportion.

EXAMPLES.

1 If 7 men can reap 84 acres of wheat in 12 days, how many men can reap 100 acres in 5 days ? Ans. 20 men.

If 84 } 7 { 100
12 } { 5 inverse extremes.

5 12

420 100

1200

7

420(8400(20men.
840

0

QUESTIONS IN REDUCTION.

What is Reduction?

How are large numbers or names brought into less ones?

How are small numbers or names brought into greater ones?

How is Reduction proved?

How many shillings and pence make a dollar in sterling, and in each of the states?

What is the federal value of an English guinea?

What is the federal value of a French guinea?

What is the federal value of a pennyweight of gold?

What is the federal value of an ounce of silver?

What is the rule for changing the currency of each state into Federal money?

How do we change federal money into the currency of each of the states?

QUESTIONS IN VULGAR FRACTIONS.

What is a Vulgar Fraction?

How is a Vulgar Fraction expressed?

Of a fraction, which is called the numerator, and which the denominator?

When is a fraction said to be in its least or lowest term?

How is a fraction reduced to its lowest terms?

What is the common measure?

How is the value or quantity of a fraction reduced to the known parts of an integer?

QUESTIONS IN THE SINGLE RULE OF THREE.

What does the Single Rule of Three teach?

What proportion exists between the terms given and the one found?

Of the three terms given, how many are the supposition, and what is the other one called?

In stating the questions which number must be placed in the third place?

What is the rule for placing the first and second terms?

When the first and second terms are not of the same denomination, what must be done with them?

What must be done with the third when it has different denominations?

After having reduced the three terms (if necessary) to their proper denominations, what further is to be done?

Which of the given terms, is the fourth or answer, like?

How is the Single Rule of Three proved?

How are questions in Inverse Proportion solved?

QUESTIONS IN PRACTICE.

What is Practice?

How may Practice be proved?

Repeat the table of aliquot parts of a pound, of a shilling, of a penny, of a dollar, and of an cwt.

What is understood by the aliquot part or parts of a number?

If the given price be a halfpenny or a farthing, how do we take parts?

How do we take parts when the given price is three farthings?

When a remainder occurs how do we proceed with it?

When the given price is a penny or more, but less than a shilling, how are the parts taken?

How are the parts taken when the price given is more than one shilling, but less than two?

How do we proceed when the price given is any number of shillings under 20?

When the price is shillings and pence; or shillings, pence, and farthings, how do we proceed?

When the price is pounds, or pounds, shillings, &c. what is the rule for obtaining the answer?

What is the rule when the price of an integer and the quantity, are of divers denominations?

QUESTIONS IN TARE AND TRET.

What is Tare and Tret?

What is Tare?

What is Tret?

What is Gross ?
What is Suttle ?
What is Neat Weight ?
When the Tare is so much in the whole gross weight, how is the neat weight found ?
When the Tare is so much per barrel, box, bag, &c. how is the neat weight found ?
How is the neat weight found, when the Tare is so much per cwt. ?
How is the neat weight found when Tret is allowed with the Tare ?

QUESTIONS IN DOUBLE RULE OF THREE.

What is Double Rule of Three ?
Of the five terms given, how many of them are suppositions ?
In stating a question, which of the two terms must be placed in the third place ?
How are the other terms in the question placed.
After stating the question, how are we to know whether the question is in Direct or Inverse Proportion ?
How do we obtain the answer, or sixth term, after having stated the question correctly ?
Which of the terms is the answer or sixth term like ?
How is the operation performed in Inverse Proportion ?

INTEREST.

Interest is a consideration allowed for the use of money; relative to which there are four particulars, viz.

First, the *principal*, or sum at interest,

Second, the *time* the principal is at use,

Third, the *rate per cent.* or interest, of £100 or dollars, for one year,

Fourth, the *amount*, which is the sum of the principal and interest added together.

Interest is either Simple or Compound.

SIMPLE INTEREST.

Simple Interest is that which arises from the principal only.

CASE I.

When the time is one year, and the rate per cent. is pounds or dollars only.

RULE.

Multiply the principal by the rate per cent. and divide the product by 100.

PROOF.

By the Double Rule of Three.

EXAMPLES.

1 What is the interest of £420 for 1 year, at £7 per cent. per annum? Ans. £29 8s.

2 What is the interest of £745 16s for 1 year, at £7 per cent. per annum? Ans. £52 4s. 1¼d.

(1)		(2)	
£		£	s.
420		745	16
7			7
29)40		52)20	12
20			20
8)00			4 12
			12
			1)44
			4
			1)16

Ans. 29*l.* 8*s.*

3 What is the interest of £800 for one year at 7 per cent. per annum? Ans. £56.

4 What is the interest of £347 10s. for one year, at 6 per cent. per annum? Ans. £20 17s.

5 What is the interest of £211 5s. for 1 year, at 7 per cent. per annum? Ans. £14 15s. 9d.

6 What is the interest of £350 17s. 8d. for one year, at 6 per cent. per annum? Ans. £21 1s. $0\frac{1}{2}$d.+

7 What is the interest of £76 for one year, at 5 per cent. per annum? Ans. £3 16s.

8 What is the interest of £268 for one year, at 4 per cent. per annum? Ans. £10 14s. $4\frac{3}{4}$d.+

9 What is the interest of £270 10s. 6d. for one year, at 5 per cent. per annum? Ans. £13 10s. $6\frac{1}{2}$d.+

10 What is the interest of £472 1s. for one year, at 7 per cent. per annum? Ans. £33 0s. $10\frac{1}{4}$d.+

Note 1. When the principal consists of dollars, multiply by the rate per cent. the product will be the interest for one year in cents.

11 What is the interest of $542 for one year, at 7 per cent. per annum? Ans. $37 94cts.

Dolls.
542
7
$37 94

12 What is the interest of $756 for one year, at 7 per cent per annum? Ans. $52 92cts.

13 What is the interest of 800 dollars for one year at 6 per cent. per annum? Ans. $48.

14 What is the interest of 326 dollars for one year at 7 per cent? *Ans.* $22 82cts.

NOTE 2. When the principal is dollars and cents, multiply by the rate per cent. and separate one figure to the right of the product (as a remainder or fraction) and what is left will be the interest for one year in mills.

When the principal is dollars, cents and mills, then cut off two for a remainder, and what is left will be mills.

15. What is the interest of 438 dolls. 25cts. at 7 per cent. per annum? *Ans.* $30 67cts. 7m.

Dolls.	Cts.
438	25
	7
$30	67 7/5

16. What is the interest of $875 35cts. for one year at 6 per cent. per annum? *Ans.* $52 52cts. 1m.

17. What is the interest of $527 14cts. for one year at 7 per cent. per annum? *Ans.* $36 89cts. 9m.+

NOTE 3.—When the amount is required, add the principal to the interest.

18. What is the amount of 273*l.* 15s. for one year at 7 per cent. per annum? *Ans.* 292*l.* 18s. 3d.

19. What is the amount of 173*l.* 17s. 8½d. for one year at 7 per cent. per annum? *Ans.* 186*l.* 1s. 1¾d.+

20. What is the amount of a bond for $387 50cts. for one year at 6 per cent. per annum? *Ans.* $410 75cts.

CASE 2.

When there is a fraction, as ¼, ½, ¾, &c. in the rate per cent.

RULE.

Multiply the principal by the rate per cent.; to the product add ¼, ½, or ¾ of said principal, and divide by 100 for the interest required.

EXAMPLES.

1 What is the interest of 526*l.* 10s. for one year, at 5½ per cent. per annum? *Ans.* 28*l.* 19s. 1¼d.

2 What is the interest of $428 for one year, at 6¼ per cent. per annum? *Ans.* $28 89cts.

(1)

£	s.
½ | 526	10
	5½
2632	10
263	5
28)95	15
20	
19)15	
12	
1)80	
4	
3)20	

(2)

Dollars

½ | ½	428	
	6¼	
	2568	
¼ | ¼	214 for ½	
	107 for ¼	
	$28 89cts.	

3 What is the interest of 216*l.* 5s. for one year, at 5½ per cent. per annum? Ans. 11*l.* 17s. 10½d.

4 What is the interest of 400*l.* for one year, at 6¼ per cent. per annum? Ans. 25*l.*

5 What is the interest of 855*l.* 17s. 6d. for one year, at 5½ per cent. per annum? Ans. 49*l.* 4s. 3d. +

6 What is the interest of $300 for one year at 6¼ per cent. per annum? Ans. $18 75cts.

7 What is the interest of $426 18cts. for one year, at 4½ per cent. per annum? *Ans.* $19 17cts. 8+

CASE 3.

When the interest of a given sum for several years, is required.

RULE.

Multiply the interest of the given sum for one year, by the number of years.

EXAMPLES.

1 What is the interest of £246 18s. for 5 years at 4½ per cent. per annum? *Ans.* £52 9s. 3½d.

£	s.		£	s.	d.	
½ | 246	18		10	9	10½	interest for 1 yr.
	4½				5	years.
987	12	*Ans.* £52	9	3½		
61	14 6					
10)49	6 6					
9)86						
10)38						
1)52						

2 What is the interest of 750*l.* for 3 years at 6 per cent. per annum? *Ans.* 135*l.*

3 What is the interest of 536*l.* for 3 years at 7 per cent. per annum? *Ans.* £111 6s.

4 What is the interest of 76*l.* for 2 years at 5 per cent. per annum? *Ans.* £7 12s.

5 What is the interest of 375*l.* 10s. 6d. for 4 years, at 7 per cent per annum? *Ans.* £105 2s. 11d.+

6 What is the amount of 460*l.* for 12 years, at 6 per cent. per annum? *Ans.* £688.

7 What is the interest of £432 10s. for 3 years, at 5⅓ per cent. per annum? *Ans.* £71 7s. 3d.

8 What is the interest of $438 25cts. for 5 years, at 6 per cent. per annum? *Ans.* $131 47½cts.

9 What is the interest of a bond of $875 35cts. for 5⅓ years at 6 per cent.? *Ans.* $288 86½cts.

10 What is the interest of £1711 15s. for 2 years, at 5⅔ per cent. per annum? *Ans.* £196 17s.+

11 What is the interest of £397 9s. 5d. for 2 years ¼, at 3⅓ per cent. per annum? *Ans.* £31 0s.+

12 What is the amount of a mortgage of 1256 dolls. which has continued 4 years, at 6 per cent. per annum?
Ans. $1557 44cts.

CASE 4.

When the time is months, weeks, or days, less or more than a year.

RULE.

As the months, weeks, or days in a year,
Are to the months, weeks, or days in the time given,
So is the interest of the given sum for a year;
To the interest required.

Or, take the aliquot parts of the yearly interest, for the given parts of a year.

EXAMPLES.

1 What is the interest of 300*l.* for 5 years and 10 months, at 4¾ per cent. per annum? *Ans.* £83 2s. 6d.

½	¼	£ 300
		4¾
		1200
¼	⅓	150
		75
		14)25
		20
		5)00

As 12 : 70 : 14 5 : 83 2 6 *Ans.*

Or thus,

M.		£ s.
6	½	14 5 int. for 1 year.
4	⅓	5
		71 5
		7 2 6
		4 15 0
		£83 2 6 *Ans.*

2 What is the amount of $64 58cts. for 3 years, 5 months and 10 days, at 5 per cent per annum? Ans. $75 70cts.

Mo.		Dols.	cts.	
		64	58	
			5	
4	$\frac{1}{3}$	322	90	interest for 1 year in cents.
			3	
		968	70	do. for 3 years.
1	$\frac{1}{3}$	107	63	do. for 4 months.
10 days	$\frac{1}{3}$	26	90	do. for 1 month.
		8	96	do. for 10 days.
		1112	19	or $11 12cts. $1\frac{9}{10}$m. interest.
			64	58 principal.
				Ans. 75 70 amount.

3 What is the interest of £150 19s. for 3 years and 4 months, at 6 per cent. per annum? Ans. £30 3s. 9d.+

4 What is the interest of £150 16s. 8d. for 4 years and 7 months, at 6 per cent. per annum? Ans. £41 9s. 7d.

5 What is the interest of £57 17s. 8d. for three months at 6 per cent. per annum? Ans. 17s. $4\frac{1}{2}$d.+

6 What is the interest of 7500 dollars for 4 months at 7 per cent. per annum? Ans. $175

7 What is the interest of 400l. for a week, at 5 per cent. per annum? Ans. 7s. $8\frac{1}{2}$d.+

8 What is the interest of £126 12s. for 16 weeks at $4\frac{1}{2}$ per cent. per annum? Ans. £1 15s. $0\frac{1}{2}$d+

9 What is the interest of $824 15cts. for 22 weeks, at 7 per cent. per annum? Ans. $24 40cts. 7m.+

10 What is the interest of £250 for 73 days at 7 per cent. per annum? Ans. £3 10s.

11 What is the interest of £240 for 120 days at 4 per cent. per annum? Ans £3 3s. $1\frac{1}{2}$d.+

12 What is the interest of $394 for 36 days, at 6 per cent. per annum? *Ans.* $3 62cts. 6m.+

13 What is the interest of $438 24cts. for 4 years, 9 months and 14 days, at 7 per cent. per annum?

Ans. $146 90cts. 7m.+

14 What is the interest of £71 3s. 11½d. for 1 year, 5 months, and 25 days, at 6 per cent. per annum?

Ans. £6 6s. 11d+

15 What is the amount of $221 75cts. for 3 years, 7 months, and 6 days, at 6 per cent. per annum?

Ans. $269 64cts. 7m. +

CASE. 5.

To find the principal, when the amount, time, and rate per cent. are given.

RULE.

As the amount of 100 pounds, or dollars, at the rate and time given,
Is to the amount given;
So is 100 pounds, or dollars,
To the principal required.

EXAMPLES.

1 What principal, at interest for 5 years at 6 per cent. per annum will amount to £650. Ans. £500.

£ 6 5 years.

30 int. of £100 for 5 years.
100
130 amount of £100 for 5 years.

As £ 130 : £ 650 : £ 100
650

130)65000(500 Ans.
650
00

2 What principal, at interest for 10 years, at 6 per cent. per annum, will amount to £1300. Ans. £812 10s.

3 What principal at interest for 4 years at 7 per cent. per annum, will amount to $576. *Ans.*. $450.

CASE 6.

To find the rate per cent. when the amount, time, and principal are given.

RULE.

As the product of the time and principal,
Is to 100 pounds or dollars;
So is the interest for the whole time,
To the rate per cent.

EXAMPLES.

1 At what rate per cent. per annum, will £500 amount to £650 in 5 years?

£	£
500 principal.	650 am't.
5 years.	500
2500	150 int.

£ £ £
As 2500 : 100 : : 150
150
2500)15000(6 *per cent. A.*
15000

2 At what rate per cent. per annum, will £500 amount to £725 in 9 years? Ans. 5 per cent.

3 At what rate per cent. per annum, will $600 amount to $856 50cts. in 9 years and 6 months. Ans. 4½ per cent.

CASE 7.

To find the time, when the principal, amount and rate per cent. are given.

RULE.

As the interest of the principal for one year,
Is to the whole interest;
So is one year,
To the time required.

EXAMPLES.

1 In what time will £500 amount to £725 at 5 per cent. per annum? Ans. 9 years.

£	£
500	725
5	500
25)00	225

£ £ y.
As 25 : 225 : : 1
1
25)225(9
225

2 In what time will £540 amount to £734 8s. at 4 per cent. per annum? Ans. 9 years.

3 In what time will $837 amount to $1029 51cts. at 5¾ per cent. per annum? Ans. 4 years.

4. A testator left his son, besides providing for his education, &c. $1500, to receive the amount thereof at 6 per cent. per annum, when he should arrive at the age of 21 years, which his guardian then found to be $2332 50cts.—How old was the boy at his father's decease? Ans. 11 yrs. 9 mo.

INSURANCE, COMMISSION, AND BROKAGE.

Insurance, Commission, and Brokage, are allowances made to insurers, factors and brokers, at a stipulated rate per cent. as a compensation for their services.

RULE.

Work as if to find the interest of the given sum for one year, at the proposed rate; or, if the rate be less than 1 per cent. take such aliquot part or parts of the interest at 1 per cent. as the rate is of a pound, or dollar.

EXAMPLES.

1 What will be the commission on £930 10s. at 3¼ per cent.? Ans. £30 4s. 9¾d.+

£.	s.	
930	10	
		3¼
2791	10	
232	12	6
30)24	2	6
20		
4)82		
12		
9)90		
4		
3(60		

£. s. d.
Ans. 30 4 9¾

2 What may a broker demand for brokage, when he sells goods to the value of 500*l.* 10s. 7d. and I allow him 7s. per cent. ? *Ans.* 1*l.* 15s. 0¼d.+

£	s.	d.
5)00	10	7
20		
0)10		
12		
1)27		
4		
1)08		

		£	s.	d.	qr.	
5	¼	5	0	1	1	at 1*l.* per cent.
2	$\frac{1}{100}$	1	5	0	1	
			10	0	0	.
		£1	15	0	1	*Ans.*

3 What is the commission on 287*l.* 10s. at 3½ per cent. ? *Ans.* 10*l.* 1s. 3d.

4 If I employ a broker to sell goods for me to the value of 2575*l.* 17s. 6d. what is the brokage at 4s. per cent. ? Ans. 5*l.* 3s. 0½d.+

5 What is the insurance of an East India ship and cargo, valued at 14813*l.* 15s. at 15½ per cent. ? Ans. 2333*l.* 3s. 3¾d.

6 What is the commission on $312 at 12 cents per dollar ? Ans. $37 44cts.

7 If a broker is employed to buy a quantity of goods, to the value of 975*l.* 6s. 4d. what is the brokage at 6s. 6d. per cent. ? Ans. 3*l.* 3s. 4½d.+

8 What is the brokage on 1321*l.* 11s. 4d. at 1½ per cent. ? Ans. 14*l.* 17s. 4d.+

9 What is the insurance of a house valued at $1853 at 75 cents per cent. ? Ans. $13 89¼cts.

COMPOUND INTEREST.

Compound Interest is that which arises from any principal and its interest put together, as the interest becomes due; and for this reason it is called Compound Interest.

RULE.

Find the amount of the given sum by Simple Interest for the first year, which will be the principal for the second year; then find the amount of that principal for the second year,

and that will be the principal for the third year; and so on for any number of years.

From the last amount, subtract the given principal, and the remainder will be the compound interest.

EXAMPLES.

1 What is the compound interest of 500*l.* for 3 years at 5 per cent.? Ans. 78*l.* 16s. 3d.

£	£	£
Principal 500	500 principal	525 principal
5 per cent.	25 int. for 1 year.	5 [for 2d year
25)00	525am. of 1st year.	26)25
		20
		5)00

525
26 5

551 5 amt. of 2d year.
5

27)56 5
20

11)25
12

3)00

£	s.	d.	
551	5		
27	11	3	
578	16	3	am. 3d year
500	0	0	principal
£78	16	3	interest.

2 What is the compound interest of 450*l.* for 3 years at 5 per cent. per annum? Ans. 70*l.* 18s. 7½d.

3 What is the amount of 550*l.* 10s. for 3 years, at 7 per cent. per annum, compound interest? Ans. 674*l.* 7s. 8¼d.+

4 What is the compound interest of $500 for 4 years, at 6 per cent. per annum? Ans. $131 23cts. 8m.+

5 What will $1200 amount to in 4 years, at 4½ per cent. compound interest? Ans. $1417 37cts. 6m.+

6 How much will 400*l.* amount to in 4 years, at 6 per cent. compound interest? Ans. 504*l.* 19s. 9¼d.+

DISCOUNT.

Discount is an allowance made for the payment of a sum of money before it becomes due, according to a certain rate per cent. agreed on between the parties concerned.

The *Present Worth* of any sum, or debt, due some time hence, is such a sum, as, if put to interest, for that time, at a certain rate per cent. would amount to the sum, or debt.—(See case 5, Simple Interest.)

RULE.

As the amount of 100 pounds, or dollars, at the rate and time given,

Is to the whole debt;

So is 100 pounds or dollars,

To the present worth.

Subtract the present worth from the whole debt, and the remainder will be the discount.

PROOF.

Find the amount of the present worth for the time and rate proposed, which must equal the given sum or debt.

EXAMPLES.

1 What is the present worth, and what the discount of 500*l*. payable in 10 months, at 5 per cent. per annum?

Ans. { Present worth, 480*l*. / Discount, 20*l*.

m. m. £
As 12 : 10 :: 5
5

£ s. d.
12)50(4 3 4 int. of 100*l*. for 10m.
48
2
20
12)40(3
36
4

£ s. d.
100 0 0
4 3 4
104 3 4 am. of 100*l*. for 10 mo.

£ s. d. £ £ £
As 104 3 4 : 500 :: 100 : 480 pres. worth

£
500
480 present worth.
20 discount.

2 Bought goods to the value of 109*l.* 10s. to be paid at 9 months, what present money will discharge the same, if I am allowed 6 per cent. per annum, discount?

Ans. 104*l.* 15s. 3½d.+

3 What is the present worth of 161*l.* 10s. for 19 months, discount at 5 per cent. per annum? *Ans.* 149*l.* 13s. 9½d.+

4 What is the present worth of $430 67cts. for 19 months, discount at 5 per cent.? *Ans.* $399 07cts.+

5 What is the rebate of 112*l.* 12s. for 20 months at 7 per cent. per annum? *Ans.* 11*l.* 15s. 3½d.+

6 What is the present worth of $240 one half payable at 4 months, and the other half at 8 months, discount at 5 per cent. per annum? *Ans.* $234 16cts. 2m.+

7 What is the present worth of 100*l.* one quarter due in 3 months, and the remaining three quarters in 5 months, discount at 7 per cent. per annum? *Ans.* 97*l.* 8s. 10½d.+

8 Bought goods amounting to $615 75cts. at 6 months credit; how much ready money must be paid, if a discount of 4½ per cent. per annum be allowed? *Ans.* $602 20cts.+

9 What is the difference between the interest of $1204 at 5 per cent. per annum, for 8 years; and the discount of the same sum for the same time and rate per cent.?

Ans. $137 60cts.

EQUATION.

Equation is a method of reducing several stated times, at which money is payable, to one mean or equated time.

RULE.

Multiply each payment by its time, add the several products together, and divide the sum by the whole debt, the quotient will be the answer.

PROOF.

The interest of the sum payable at the equated time, at any given rate, will equal the interest of the several payments for their respective times, at the same rate.

EXAMPLES.

1 A owes B 380 dollars to be paid as follows, viz. $100 in 6 months, 120 dollars in 7 months, and 160 dollars in 10 months: What is the equated time for the whole debt?

Ans. 8 months:

100	120	160
6	7	10
600	840	1600
		840
		600
		380)3040(8
		3040

2 C owes D 100 dollars, of which 50 dollars is to be paid at 2 months, and 50 at 4 months; but they agree that the whole shall be paid at one time: When must it be paid?

Ans. 3 months.

3 A merchant hath owing to him 300*l.* to be paid as follows, 50*l.* at 2 months, 100*l.* at 5 months, and the rest at 8 months: and it is agreed to make one payment of the whole, when must that be made? *Ans.* 6 months.

4 B owes C 800*l.* whereof 200*l.* is to be paid at 3 months, 100*l.* at 4 months. 300*l.* at 5 months, and 200*l.* at 6 months; but they agree to make one payment of the whole; I demand what time that must be? *Ans.* 4 months, 18 days.+

5 K is indebted to L a certain sum, which is to be discharged at 4 several payments that is ¼ at 2 months, ¼ at 4 months, ¼ at 6 months and ¼ at 8 months; but they agreeing to make one payment of the whole, the equated time is therefore demanded. *Ans.* 5 months.

6 A merchant purchased goods to the amount of $2000 whereof 400 dols. are to be paid present, 800 dols. at 5 months, and the rest at 10 months, but they agree to make one payment of the whole; what is the equated time?

Ans. 6 months.

7 P owes Q 420*l.* which will be due 6 months hence; but P is willing to pay him 60*l.* now, provided he can have the rest remain unpaid a longer time than 6 months; when must it be paid? *Ans.* in 7 months.

60 420 6
360 360 1
360 Ans

BARTER.

Barter is the exchanging of one commodity for another, according to the price or value agreed upon by the parties concerned.

RULE.

Find the value of the commodity whose quantity is given, then find what quantity of the other at the proposed rate can be bought for the same money, and it gives the answer.

EXAMPLES.

1 How much tea at 64 cts. per lb. must be given in barter for 4 cwt. of rice at 4½ cts. per lb.

Ans. 31 lb 8oz. or ½ lb

lb Cwt. cts. cts. cts. lb
As 1 : 4 : : 4½ As 64 2016 1
112 1
448 lb oz.
4½ 64)2016(31 : 8 an.
192
1792 96
224 64
$20 16 value of the rice. 32
16
oz.
64)512(8
512

2 How much tea at 9s. per lb. can I have in barter for 4 cwt. 2 qrs. of chocolate at 4s. per lb. Ans. 2 cwt.

3 How much sugar at 9d. per lb should be bartered for 6½C. of tobacco, at 14d. per lb. *Ans.* 10 cwt. 0qr. 12lb⅘

4 How much wheat at $1 25cts a bushel must be given in barter for 50 bushels of rye, at 70 cts. a bushel?

Ans. 28 bushels.

5 How much rice at $3 36 cts. per cwt. must be bartered for 3½ cwt. of raisins, at 5 cts. per lb *Ans.* 5cwt. 3qr 9lb+

6 Suppose C has tea at 8s. 6d. per lb. ready money, but in barter he will have 10s. per lb. D has tobacco worth 18d. per lb ready money; how much must he rate his tobacco *per lb to equal* the tea in value? *Ans.* 1s. 9d.+

7 A had 41 cwt. of iron at 30s. per cwt. for which B gave him 20*l.* in money, and the rest in pork at 5d. per lb. how much pork must be given besides the 20*l* ? *Ans.* 1992lb.

8 How much sugar at 8d. per lb. must be given in barter for 20 cwt. of tobacco, at 3*l.* per cwt. *Ans.* 16cwt. 0qr. 8lb.

9 A and B barter : A has 320 lb. of chocolate at 4s. 6d. per lb. for which B is to give him 30*l.* in money, and the rest in cotton, at 8d. per lb. How much cotton is B to give A ?
Ans. 1260 lbs.

10 How many dozen lb. of candles, at 5s. 2d. per dozen must be delivered in barter for 3cwt. 2qr. 16lb. tallow, at 37s. 4d. per cwt. Ans. 26 doz 3 lb.+

11 A and B barter ; A hath 41 cwt. of hops at $4 50cts. per cwt. for which B gave him 28 dols. 50cts. in money, and the rest in salt, at 80 cts. per bushel, how much salt must B give A besides the money ? Ans. 195 bushels.

12 H has 28½ bushels of wheat at 11s. 7d. per bushel, for which I is to give him 40 bus. of rye, at 7s. 4d. per bus how much money must H receive ? Ans. £1 16s. 9½d.

13 R gave 189 yards of linen at 6s. 8d. per yard to L for 42 yards of cloth ; what was the cloth per yard ? Ans. 30s.

14 A and B barter : A has 145 barrels of flour at $8 per barrel, ready money, but in barter he will have $8¾ : B has salt at $1¼ per bushel ready money ; how must B sell his salt per bushel in proportion to A's bartering price, and how many bushels are equal to A's flour ?

Ans. { B's bartering price $1 36 7+ and must give A 928 bus.

LOSS AND GAIN.

Loss and gain is a rule that discovers what is gained or lost in buying or selling of goods ; and teaches to rise or fall the price, so as to gain or lose so much per cent. or otherwise.

The questions in this rule are performed by the Rule of Three.

1 When the buying and selling prices are given to find what is gained or lost by selling.

RULE.

First find the value of the commodity at the price it cost ; then find its value at the price sold at, the difference between

these will be the gain or loss; Or, As 1 yard, lb. &c.; is to the quantity given; so is the gain or loss of one yard, lb. &c. to the whole gain or loss.

2 To find what is gained or lost per cent.

RULE. First find the gain or loss by subtraction;—then As the prime cost; is to 100*l.* or dollars; so is the gain or loss; to the gain or loss per cent.

3 To find at what rate goods must be sold, to gain or lose so much per cent.

RULE. As 100*l.* or dollars; is to 100*l.* or dollars, with the profit added, or loss subtracted; so is the prime cost; to the gaining or losing price.

4 The gain or loss per cent. being known to find what the goods cost.

RULE. As 100*l.* or dollars with the gain per cent. added, or loss per cent. subtracted; is to 100*l.* or dollars; so is the selling price; to the prime cost.

5 When so much is gained or lost by selling goods at a certain rate, to find the gain or loss if sold at any other rate.

RULE. As the first price; is to the other price; so is 100*l.* or dollars, adding the gain per cent. or subtracting the loss per cent.; to the gain or loss per cent.

If the answer exceed 100*l.* or dollars, the excess is the gain per cent; if less than 100*l.* or dollars, the deficiency is the loss per cent.

EXAMPLES.

1 A storekeeper sold 100 yards of silk, at $1 50cts per yard, which cost him $1 25cts. per yd.; how much did he gain by the sale.

$1 50		yd.	yd.	cts.
$1 25	As	1	: 100	:: 25
25 gained per yd.			25	
			$25 00	Ans. Whole gain.

2 Bought 18 cwt. of iron, at 28s per cwt. and retailed it at 3½d. per lb.; what is gained in the whole?

Ans. gained £4 4s.

Cwt.	cwt.	s.
As 1	: 18	:: 28
		18
		224
		28
		2)0)50(4
		£25 4 prime cost.

lb.	Cwt.	d.
As 1	: 18	:: 2½
		112
		2016
		3½
		6048
		1008
		12)7056
		2)0)58(8
		29 8 sold for
		25 4
		£4 4 Ans.

3 A merchant bought 53 yards of silk, at 12s. per yard; and afterwards sold it at 14s. per yard; how much did he gain by the sale? Ans £5 6s.

4 A merchant bought 650lb. of sugar, at 10 cents per lb. and sold it at 12 cents per lb.; how much did he gain?

Ans. $13 00

5 Bought a piece of baize of 42 yards, for 4*l.* 14s. 6d. and sold it at 2s. 6d. per yard: what is the gain or loss on the whole piece. Ans. 10s. 6d. gain.

6 If 1 lb. of tobacco cost 16d. and is sold for 20d. what is the gain per cent.? Ans. 25*l.*

7 If I buy 437 yards of muslin for 2s. 3½d. per yard, and sell it at 4s. 8d. per yard; how much do I gain?

Ans. £8 3s. 10½d.

8 If I buy tea at $1 per lb. and sell it again at 87½ cents, per lb.; what is lost per cent? Ans. 12½ per cent.

9 If 980 lb. of merchandize are bought for £61 5s. and sold for £69 8s. 4d.; I demand the profit on each lb.

Ans. 2d.

10 If 112lb. of iron cost 27s. 6d. what must one cwt. be sold for to gain 15*l.* per cent. Ans. £1 11s. 7½d.

11 *Bought* a piece of shaloon, containing 34 yards, at 3s.

4d. per yard, and sold it at 12½ per cent. loss; how much was it sold per yard? Ans. 2s. 11d.

12 Bought 7 tuns of wine, at $67 per hogshead, which I sell out again at 19 cents per pint; what is the whole gain, and the gain per cent.

Ans. { Whole gain 805 dols. 28 cts.
{ Gain per cent 42dols. 92½ cts.+

13 If 375 yards of broad cloth be sold for 490*l.* and 20 per cent profit; what did it cost per yard? *Ans.* £1 1s. 9¼d.+

14 By selling broadcloth at $3 25 cts. per yard, I lose at the rate of 20 per cent; what is the prime cost of said cloth per yard? *Ans.* $4 0cts. 2½m.

15 Having sold a yard of cloth at 11s. 6d. I gained at the rate of 15 per cent. but if I had sold it for 12s. what should I gain per cent.? *Ans.* 20 per cent. gain.

16 If by selling cloth at $2 50cts. per yard, there is gained 10 per cent.; what is the gain or loss when it is sold at $2 10cts. per yard? *Ans.* $7 60cts. loss.

17 Bought a chest of tea, weighing 490 lb. for $326 and sold it for $370 10cts. what was the profit on each pound? *Ans.* 9 cents.

18 Bought 90 gallons of wine, at $1 20cts. per gallon, but by accident 10 gallons leaked out; at what rate must I sell the remainder per gallon, to gain 12½ per cent. on the whole cost? *Ans.* $1 51cts. 8m.+

19 At 3s. 6d. to the pound profit, how much per cent.? *Ans.* 17*l.* 10s. or 17½ per cent.

20 Having sold 12 yards of cloth for 5*l.* 14s. and thereby gained 8 per cent.; what is the prime cost of a yard? *Ans.* 8s. 9d. 2qrs.⅝

FELLOWSHIP.

Fellowship is a rule, by which merchants, &c. trading in company with a joint stock, are enabled to ascertain each person's particular share of the gain or loss, in proportion to his share in the joint stock.

NOTE.—Also by this rule a bankrupt's estate may be divided among his creditors, &c.

Fellowship is either Single or Compound.

SINGLE FELLOWSHIP,

Is when the several stocks in company are considered *without regard to time.*

RULE.

As the whole sum, or stock,
Is to each partner's share in stock, &c.
So is the whole gain or loss;
To his share of the gain or loss.

PROOF.

The sum of the several shares must equal the gain or loss.

EXAMPLES.

1 Three merchants trading together, gained $800; A's stock was $1200, B's $4800, and C's $2000, what was each man's share of the gain?

A 1200
B 4800
C 2000

$8000

$$\text{As } \$8000 : \begin{Bmatrix}1200\\4800\\2000\end{Bmatrix} :: 800 : \begin{Bmatrix}120 \text{ A's share}\\480 \text{ B's share}\\200 \text{ C's share}\end{Bmatrix} \text{ Ans.}$$

800 proof.

2 D, E, and F, trading together gained 120*l.*; D's stock was 140*l.* E's was 300*l.* and F's 160*l.*; what was each man's share of the gain?

Ans. D's share was 28*l.* E's 60*l.* F's 32*l.*

3 Three merchants trading to Virginia, lost goods to the value of $1920; now suppose A's stock was $2880, B's $11520, C's $4800; what sum must each man sustain of the loss? Ans. A $288; B $1152; C $480.

4 A, B and C freighted a ship with 108 tuns of wine, of which A had 48 tuns, B 36, and C 24; but by reason of stormy weather were obliged to cast 45 tuns overboard; how much must each man sustain of the loss?

Ans. A 20 tuns, B 15, and C 10.

5 A Silversmith breaking, owes to 4 men the following sums of money, viz. to A, 21*l.* 9s. 6d.; to B, 72*l.* 19s. 3d.; to C, 114*l.* 13s. 9d.; to D, 264*l.* 17s. 6d.; his whole estate is found to be but 148*l.* 2s. 6d.: what must each have of the same, and what will it be per pound?

		£	s.	d.	
Ans.	A	6	14	$2\frac{1}{2}$	5688
	B	22	16	0	8532
	C	35	16	$0\frac{1}{2}$	2844
	D	82	15	$5\frac{1}{2}$	5688
	at 6s. 3d. per lb.				

6 Four men traded with a stock of $2400, and they gained in 2 years, twice as much, and $160 more; A's stock was $400, B's $740, C's $820; what was D's stock, and how much did each man gain by trading?

		$	cts.	m.
Ans.	D's stock was $440 and A gained	826	66	6+
	B ——	1529	33	3+
	C ——	1694	66	6+
	D ——	909	33	3+

COMPOUND FELLOWSHIP

Is when the respective stocks in company are considered with time.

RULE.

Multiply each man's stock by its time and add the several products together; then,

As the sum of the products,
Is to each particular product;
So is the whole gain or loss,
To its share of the gain or loss.

EXAMPLES.

1 Three merchants traded together; A put in 120*l.* for 9 months, B 100*l.* for 16 months, and C 100*l.* for 14 months, and they gained 100*l.*; what is each man's share?

	£		m.	
A's stock	120	×	9	= 1080
B's stock	100	×	16	= 1600
C's stock	100	×	14	= 1400
			Sum	4080

	Product.		£	£ s. d.
Sum.	1080			26 9 $4\frac{1}{4}$ + A's share.
As 4080 :	1600	:: 100 :		39 4 $3\frac{3}{4}$ + B's share.
	1400			34 6 $3\frac{1}{4}$ + C's share.

2. Three merchants traded together, with a capital of $2300, of which A put in $620 for 8 months; B $950 for 11 months, and C $730 for 13 months, and they gained $1800; what was each man's share?

		Dolls.	cts.	m.
Ans	A's share	358	55	$4\frac{54}{115}$
	B's ——	755	42	$1\frac{174}{345}$
	C's ——	686	02	$4\frac{224}{345}$

3. Three merchants joined in company, D puts in stock 195*l.* 14s. for 3 months, E 179*l.* 18s. 3d. for 5 months, and F 59*l.* 14s. 10d. for 11 months; they gained 364*l.* 18s.—what is each man's part of the gain?

		£	s.	d.	
Ans.	D's share	99	18	$7\frac{1}{4}$	75455
	E's ——	153	2	$3\frac{1}{4}$	28250
	F's ——	111	17	1	410812

4. A, B, and C, made a stock for 12 months; A put in at first $873 60cts. and 4 months after he put in $6 more; B put in at first $979 20cts. and at the end of 7 months he took out $206 40cts.; C put in at first $355 20cts. and 3 months after he put in $206 40cts. and 5 months after that he put in $240 more. At the end of 12 months their gain is found to be $3446 40cts.; what is each man's share of the gain?

Ans	A's share	$1334	82+
	B's ——	$1271	61+
	C's ——	$ 839	96+

EXCHANGE.

Exchange is a rule by which the money of one state or country is reduced to that of another.

Par is equality in value; but the course of exchange is frequently above or below par.

Agio, is a term used to signify the difference, in some countries, between bank and current money.

Note.—A Spanish dollar is valued at 4s. 6d. sterling, and at 8s. New-York currency: 4s. 6d. sterling is therefore equal to 8s. New-York currency, and 100*l.* of the former is equal to 177⅞ of the latter. When exchange between England and New-York is at this rate, it is said to be at par.

DOMESTIC EXCHANGE

Is to change the currency of each state into that of any other.

RULE.

Work by the Single Rule of Three, thus;

As the value of a dollar in the currency given,
Is to the value of a dollar in the currency required;
So is the sum given,
To its value required.

Or, By the theorem in the following table:—

A TABLE,

Exhibiting the value of a dollar in each of the United States; and practical Theorems for exchanging the currency of either, into that of any other.

To exchange from / to	New England States and Virginia.	Pennsylvania, Jersey, Delaware and Maryland.	New-York and North Carolina.	South Carolina, and Georgia.
*New England States & Virginia.	Dollar, 6s. 0d.	Add one 4th.	Add one 3d.	Multiply by 7 and divide product by 9
Pennsylvania, N. Jersey Delaware & Maryland.	Subtract one 5th.	Dollar. 7s. 6d.	Add one 15th.	Multiply by 28 & divide prod. by 45
New-York and North Carolina.	Subtract one 4th.	Subtract one 16th.	Dollar 8s. 0d.	Multiply by 7 & divide product by 12
South Carolina and Georgia.	Multiply by 9, and divide product by 7.	Multiply by 45, & div. product by 28.	Multiply by 12, & divide product by 7.	Dollar 4s. 8d.

*The New-England states are New-Hampshire, Massachusetts, Rhode Island, Connecticut and Vermont.

EXAMPLES.

1 What is the value of 750*l.* Massachusetts currency in New York? *Ans.* 1000*l.*

	s.	s.	£
As	6	8	:: 750
			20
			15000
			8
			6)120000
			2(0)2000(0
			£1000

or thus,

8)750
250

£1000

2 What is the value of 1500*l.* Massachusetts currency in New-York? *Ans.* 2000*l.*

3 What is the value of 100*l.* Pennsylvania currency in New-Hampshire? *Ans.* 80*l.*

4 What is the value of 933*l.* 6s. 8d. South Carolina currency in Pennsylvania? *Ans.* 1500*l.*

5 What is the value of 120*l.* 8s. 3d. New-England currency in New-York? *Ans.* 160*l.* 11s. 0d.

6 Reduce 116*l.* 10s. New-York currency, into Connecticut currency? *Ans.* 87*l.* 7s. 6d.

7 What sum in Pennsylvania currency is equal to 120*l.* 10s. in New-York? *Ans.* 112*l.* 19s. 4½d.

8 Change 112*l.* 7s. 3d. South-Carolina currency into Vermont currency. *Ans.* 144*l.* 9s. 3¾d.+

9 What is the value of 800*l.* New-York currency in Pennsylvania? *Ans.* 750*l.*

10 Reduce 214*l.* 9s. 2d. New-Jersey currency into Massachusetts currency. *Ans.* 171*l.* 11s. 4d.

11 C of Rhode Island owes D of Philadelphia 108*l.* 10s. what sum must D draw for the amount? *Ans.* 86*l.* 16s.

12 A merchant in New-York, owes 180*l.* to a planter in Virginia; what sum ought he to be charged with in the planter's books? *Ans.* 135*l.*

13 A merchant in Virginia consigns to his agent in New-York, a quantity of tobacco; which, when sold, and all

charges deducted, amount to 625*l.* 6s. what is the value thereof in Virginia currency; also in Federal money?

Ans. { 468*l.* 19s. 6d. Virginia currency.
{ $1563 25cts. Federal Money.

FOREIGN EXCHANGE.

Accounts are kept in England, Ireland, and the West India Islands, in pounds, shillings, pence, and farthings: though their intrinsic value in these places are different.

RULE.

Find the various answers in Exchange, by the Single Rule of Three, or by Practice.

A TABLE OF DIFFERENT MONEY.

The value of Foreign Coins, &c. in Federal Money, as established by a late Act of Congress.

	Dols.	cts.	m.		Dols.	cts.	m.
Pound Sterling,	4	44	4	Rupee of Bengal,	0	55	5
Pound of Ireland,	4	10	0	The Guilder of Holland,	0	39	0
Pagoda of India,	1	94	0	Mark Banco of Hamburg,	0	33	5
Tale of China,	1	48	0	Livre of France,	0	18	5
Mill-rea of Portugal,	1	24	0	Real plate of Spain	0	10	0
Ruble of Russia,	0	66	6				

FRANCE.

12 Deniers = 1 Sol
20 Sols = 1 Livre
3 Livres = 1 Crown

SPAIN.

4 Marvadies Vellon, or 2⅛ Marvadies of Plate, = 1 Quarte
8½ Quartas, or 34 Marvadies Vellon, = 1 Rial Vellon
16 Quartas, or 34 Marvadies of plate, = 1 Rial of plate
8 Rial of plate = 1 Piastre
10 Rial of plate = 1 Dollar
5 Piastres = 1 Spanish Pistole

ITALY.

12 Deniers	1 Sol
20 Sols	1 Livre
5 Livres	1 Piece of eight at Genoa
6 Livres	1 do. of Leghorn
6 Solidi	1 Gross
24 Grosses	1 Ducat

PORTUGAL.

400 Reas	1 Crusadoe
1000 Reas	1 Millrea

HOLLAND.

8 Pennings	1 Great
2 Groats	1 Stiver=2d. or cts.
6 Stivers	1 Shilling
20 Stivers	1 Florin or Guilder=40cts.
2½ Florins	1 Rix Dollar
6 Florins	1 £ Flemish
5 Guilders	1 Ducat

DENMARK.

16 Shillings	1 Mark
6 Marks	1 Rix Dollar
32 Rustics	1 Copper Dollar
6 Copper Dollars	1 Rix Dollar

RUSSIA.

18 Pennings	1 Gros
30 Gros	1 Florin
3 Florins	1 Rix Dollar
2 Rix Dollars	1 Gold Ducat

EXAMPLES.

1 London receives a bill of Exchange from New-York for 943*l.* 17s. sterling; for how much Federal money was it drawn, exchange being at par? *Ans.* $4194 88cts. 8m.+

s.	d.	£	s.	$	$	cts.	m.
As 4	6 :	943	17 : :	1 :	4194	88	8+

2 New-York is indebted to London $1474 80cts. what sterling sum must be remitted, when the exchange is at par? *Ans.* 331*l.* 16s. 7d.+

3 A merchant in Boston is indebted to his factor in Ireland 90*l.* 10s. 6d. Irish, how much Federal money will discharge the debt? Ans. $371 15¼cts.

As 1*l.* : 90*l.* 10s. 6d. :: 410cts. : $371 15¼cts.

4 In $168 10cts. how many pounds Irish? Ans. 41*l.*

5 In 250 livres of France, how many dollars and cents? Ans. $46 25cts.

6 Reduce $87 10cts. into livres of France. Ans. 470.+

7 What is the value of 241 guilders 14 stivers of Holland in Federal money? Ans. $94 26cts. 3m.

8 Reduce 1786 Reals of Plate of Spain to Federal money. Ans. $178 60cts.

9 How much Federal money is equal to 187 Mill-reas, 534 reas of Portugal? Ans. $232 54cts. 2m.+

10 In $24 92cts. how many Mill-reas of Portugal? Ans. 20.+

11 In 641 Tales of China, how many cents? Ans. 94868

12 How many Rupees of Bengal are equal to $54 39cts.? Ans. 98.

13 A of New-York, is indebted to B of London, 1474*l.* 16s. currency, how much sterling must be remitted, when the exchange is at 64 per cent.? Ans. 899*l.* 5s. 4¼d.

£	£	s.	£	£	s.	d.
As 164 :	1474	16 ::	100 :	899	5	4¼

14 Jamaica is indebted to London 1470*l.* 12s. 8d. sterling; with how much currency will London be credited at Jamaica, when the exchange is at 36⅔ per cent.?

£	£	s.	d.	£	s.	£	s.	d.	
As 100 :	1470	12	8 ::	136	10 :	2007	8	3¼	Ans.

15 What sum sterling will be equal to 260*l.* 8s. 6d. New-York currency, exchange at 44 per cent.? Ans. 180*l.* 17s.+

16 How much Pennsylvania currency is equal to 800*l.* 17s. 6½d. sterling, exchange at 67½ per cent.? Ans. 1341*l.* 9s. 4d.½+

17 New-York, ——————

Exchange for 452*l.* 10s. 6d. sterling.

Thirty days after sight of this my first of exchange, second and third of like tenor and date not paid, pay to Samuel Sims, or order, four hundred fifty two pounds, ten shillings and sixpence sterling, value received; and place the same to account, as per advice from Peter Simpson.

To Thomas Lamott, Merchant, London.

What is the value of this bill in New-York currency, exchange at 77½ per cent.? Ans. 803*l.* 4s. 7½d. +

18 A merchant in Rotterdam has a bill drawn on him for 673*l.* 16s. 8d. sterling; exchange at 33s. 4d. Flemish, per pound sterling; how much Flemish must he pay?

Ans. 1123*l.* 1s. 1½d. +

NOTE.—To change bank into current money, say: As 100 bank, is to the bank given; so is 100 with the agio added, to the current required.

To change current money to bank, say: As 100 with the agio added, is to the current money; so is 100 bank, to the bank required.

19 Change 794 guilders, 15 stivers, current money, into bank florins, agio 4½ per cent.

Result, 761 guilders, 8 stivers, 11 pennings. +

20 Change 761 guilders, 9 stivers, bank, into current money, agio 4½ per cent.

Result, 794 guilders, 15 stivers, 4 pennings. +

QUESTIONS IN INTEREST.

What is Interest, and how many parts are there belonging to it?

What are these parts called?

How many kinds of interest are there?

What is Simple Interest?

How is the interest found when the time is but for one year, and rate per cent. is pounds or dollars only?

When the principal is dollars and we multiply by the per cent. what will the product be?

When the principal is dollars and cents, after having multiplied by the per cent. how many figures must be cut off as a remainder and what are those called that are left.

When the principal is dollars, cents, and mills, after multiplying the rate per cent. what is the rule for cutting off at the right hand?

How do we get the amount of a sum?

How is the interest found when there is a fraction in the rate per cent?

How is the interest found when it is required for several years?

When the interest is required for months, weeks or days, less or more than a year how is it found?

How is the principal found when the amount, time, and rate per cent. are given?

How is the rate per cent. found when the amount, time, and principal are given?

How is the time found when the principal, amount, and rate per cent. are given?

What is insurance, commission and brokage?

What is the rule for finding the insurance, commission, &c.

What is Compound Interest?

How is the Compound Interest of any sum at a given rate and time ascertained?

QUESTIONS IN DISCOUNT.

What is Rebate or Discount?

What is the present worth?

How is the present worth of any sum at a given rate and time found?

How is the discount ascertained?

How is Rebate or Discount proved?

EQUATION.

What is meant by Equation of payments?

What is the rule for finding the Equation of time?

How is Equation proved?

BARTER.

What is Barter?

How are sums wrought in Barter?

LOSS AND GAIN.

What is Loss and Gain?

How are the questions in this rule performed?

When the buying and selling prices are given, how is the gain or loss determined?

When the prime cost and selling price are given, how is the gain or loss per cent. found?

When the prime cost is given, and a gain or loss per cent. proposed how is the selling price ascertained?

When the selling price, and the gain or loss per cent. are given, how do we find what the goods cost?

When the gain or loss per cent. is given of goods sold at a certain price, how is the gain or loss per cent. found if sold at another price?

FELLOWSHIP.

What is Fellowship?

How many kinds of Fellowship are there?

What is Single Fellowship?

How is the gain or loss of each partner's share ascertained in Single Fellowship?

What is Compound Fellowship ?

How is the gain or loss of each partner's share ascertained in Compound Fellowship ?

EXCHANGE.

What is Exchange ?

What is Par in Exchange ?

What is Agio ?

Give an example wherein the par of Exchange is said to be equal ?

What is Domestic Exchange ?

How is the currency of one state changed to that of another, retaining the same value ?

How are accounts kept in England, Ireland, and the West Indies ?

How is the currency of one country exchanged to that of another ?

What is the value of foreign coins &c. in Federal money as established by congress ?

PROMISCUOUS QUESTIONS TO EXERCISE THE LEARNER IN THE FOREGOING RULES.

1 If 14 lb. of sugar cost 13s. at what rate is that per cwt.
Ans. 5*l.* 4s.

2 Reduce 225*l.* 12s. New-York, or North-Carolina currency, to Federal money. *Ans.* 564 dols.

3 What is the interest of 78*l.* for 2 years, at 5 per cent. per annum? *Ans.* 7*l.* 16s.

4 How many sixpences are there in 160*l.* 15s. 6d.
Ans. 6431 sixpences.

5 A grocer has 34cwt. 2qrs. 12 lb. of sugar, and intends to divide it into parcels, each of which to weigh 68 pounds, how many of these parcels will there be? Ans. 57.

6 In 29 guineas, at 23s. how many farthings?
Ans. 38976qrs.

7 What is the interest of 550*l.* for 4 years, at 7 per cent. per annum. Ans. 154*l.*

8 Two men depart both from the same place, and travel the same road, the one 37 miles, and the other 45 miles every day, I demand how many miles they are distant the 12th day after their departure? Ans. 96 miles.

9 How much will 4 pieces of linen containing, viz. 35½, 36, 37¼, and 38 yards come to, at 79 cts. per yard?
Ans. $116 13 cts.

10 Bought 40 tubs of butter weighing 36 cwt. 2qrs. 14 lb. neat, for $472 5cts.; paid cooperage 12 cts. per tub; salt and labour $4 32cts. 8mills; storage $6 40cts. I would know what it stands me in per lb. *Ans.* 11 cts. 9m.

11 At 4½ per cent. what is the commission on 1525 dols.?
Ans. $68 62cts. 5m.

12 How many quintals of fish at 2 dol. per quintal, will pay for 140 tierces salt, at $4 70cts. per tierce? Ans. 329qu.

13 Change $1048 83¾ cts. to New-York currency.
Ans. 419*l.* 10s. 8¼d.+

14 The rents of a parish amount to 3590*l.* and a rate is granted of 65*l.* 12s. 6d. what is that per pound? *Ans.* 4½d.

15 If 1 cwt. of flax cost 6*l.* 6s. what is that per lb.?
Ans. 1s. 1½d.

16 What is the neat weight of 20 barrels of figs, each weighing 3cwt. 1qr. 5lb. gross, tare 14lb. per barrel?
Ans. 63cwt. 1qr. 16lb.

17 A debt of 120 dols. due as follows, viz. 50 dols. at 2 months, 40 dols. at 5 months, and the rest at 7 months; but if it be reduced to one payment, at what time must it be paid? Ans. 4 $\frac{1}{4}$ months.

18 If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses 24 days?
Ans. 120 bushels.

19 A gentleman sent a tankard to his goldsmith, that weighed 50 ounces 8 pennyweights, and ordered him to make it into spoons, each to weigh 2 ounces 16 dwt.; how many had he? Ans. 18 spoons.

20 If a gentleman's income is 500*l.* a year, and he spends 19s. 4d. per day, how much does he lay by at the year's end?
Ans. 147*l.* 3s. 4d.

21 What is the interest of 379*l.* 13s. 2d. for four weeks, at 4 per cent. per annum? Ans. 1*l.* 3s. 4$\frac{1}{4}$d.+

22 Bought 18 cwt. of cheese, at 10 dols. per cwt. which I sell out again at 12cts. per lb. what is the profit in the whole?
Ans. $61 92cts.

23 B and C traded in company; B put in 950*l.* for 5 months, and C 785*l.* for 6 months, and by trading they gained 275*l.* 18s. 4d. what was each man's share of the gain?
Ans. { B's 138*l.* 10s. 10d. / C's 137*l.* 7s. 6d.

24 If 17*l.* 10s. 3$\frac{1}{4}$d. be divided equally among 15 persons, what will each have? Ans. 1*l.* 3s. 4$\frac{1}{4}$d.

25 A gentleman dying, left 963*l.* 18s. to be divided in the following manner, viz.; to the widow he gave one third part, and the remainder was to be divided equally among 6 children; what was each one's portion?
Ans. { 321*l.* 6s. widow's portion. / 107*l.* 2s. each child's portion.

26 A tub, which holds 130 gallons, is supplied by a pipe which admits 16 gallons into it in 30 minutes; it also has a leak in the bottom, which lets out 10 gallons in the same time. Now if the water begin to come into the tub, when it is empty, in what time will it be filled? Ans. 10h. 50m.

27 What is the interest of 18*l.* for 5 weeks, at 6 per cent. per annum? Ans. 2s. 0$\frac{3}{4}$d. $\frac{3}{13}$

28 Some sportsmen having placed a fox 100 yards distant from two hounds, and starting both together, the hounds ran 2$\frac{1}{4}$ times faster than the fox; I demand how far the fox will have run before the hounds overtake him? *Ans.* 66$\frac{2}{3}$ yds.

29 If I buy cloth for 6 shillings per yard, how must I sell it per yard, so as to gain 25 per cent.? Ans. 7s. 6d.

30 If a pole perpendicular to the horizon of 50 ft. 11 inches in length, when the sun is on the meridian, cast a shadow 98 ft. 6 in. long; what is the breadth of a river, running due east and west within 20 feet 6 inches on the north side of a steeple 300 feet 8 inches high, which at the same time casts the extremity of its shadow 30 feet 9 inches beyond the stream? Ans. 176 yds. 2 ft. 4 in.+

31 What is the interest of 329*l.* 17s. 6½d. for 3 years, 7 months, and 12 days, at 5*l.* per cent. per annum?

Ans. 59*l.* 13s.+

32 A merchant began to trade with 2532*7l.*; for 6 years together, he cleared 1253*l.* per annum; the next 5 years he cleared 1729*l.* per annum; but the last 4 years, had the misfortune to lose 3019*l.* per annum; what was he worth at the 15 years' end? Ans. 2941*4l.*

33 If a field will feed 6 cows 91 days, how long will it feed 21 cows? Ans. 26 days.

34 Andrew had fine peaches, 9 of which were worth 6 cents; William had apples 8 of which were worth 2 cents; I require the number of apples that William must give Andrew for 15 of his peaches? Ans. 40.

35 A farmer had 21 bushels of Indian corn, which he wished to mix with buckwheat, and so that every bushel of the provender should contain 13 quarts of Indian corn: I demand the quantity of buckwheat in the mixture.

Ans. 30 bush. 2 pks. 6 qts.+

36 Suppose a person's age to be 15yrs. 19d. 11h. 37m. 45s. how many seconds are there in it, allowing 365 days and 6 hours to the year? Ans. 475047465.

37 I sold a watch for 50*l.* and by so doing, lost 17 per cent. whereas I ought, in trading to have cleared 20 per cent.; how much was it sold under its value? Ans. 22*l.* 5s. 9¼d.+

38 B buys of C a hogshead of coffee weighing gross 9cwt. 2qrs. tare 12 lb. per cwt. what is the neat weight of it, and how much did it amount to at 23 cents per lb.?

Ans. { Neat weight, 8cwt. 1qr. 26 lb.
Amount $218 50cts.

39 When hens are 9 shillings a dozen, what will be the price of 6 dozen of eggs at 2 cents for 3 eggs? Ans. 48cts.

40 What is the compound interest of 246*l.* 14s. 6d. for 3 years, at 6 per cent. per annum? Ans. 47*l.* 2s. 6½d.+

41 Bought wine at $1 25cts. per gallon, which not proving so good as I expected, I am willing to lose 18 per cent. by it, how must I sell it per gallon? *Ans.* $1 $2\frac{1}{2}$cts.

42 If a lever be 100 inches long, what weight, lying $7\frac{1}{2}$ inches from the end, resting on a pavement, may be moved with the force of 168 lb. lifting at the other end of the lever?

Ans. 2240 lbs.

43 Two boys are playing tag, one boy has 6 rods the start, but the other boy can run 15 rods to his 13; I demand how far the hindermost boy must run before he will overtake the other one? *Ans.* 45 rods.

44 When I sell a yard of muslin at 15d. I gain 30s. by the piece, and when I sell the yard at 14d. I gain 20s. by the same piece: I demand how many yards the piece contained?

Ans. 120.

45 When oats are 2s. a bushel, and Indian corn 4s. a bushel, what will be the price of 37 bushels of provender at 3s. a bushel? *Ans.* 5*l.* 11s.

46 A certain apple tree will bear apples sufficient to make 55 gals. of cider in a year; how much can be made in 6 years from an orchard consisting of 7 rows, and 11 trees in each row; supposing each tree to bear as well as that one?

Ans. 100 tuns, 3 hhds. 21 gals.

47 The United States pay 6 per cent. interest on part of their domestic debt, and supposing they could borrow money in Holland for $3\frac{1}{2}$ per cent. how much would they gain annually, by borrowing a million dollars in Holland, and applying it to the payment of said debt? *Ans.* $25000.

48 What is the present worth of $5150 due in $4\frac{1}{2}$ months, discounting at the rate of 8 per cent. per annum, and allowing 1 per cent. on the present worth for prompt pay?

Ans. $4950.

49 What is the sterling value of 477*l.* 8s. 8d. New-York currency? *Ans.* 268*l.* 11s. $1\frac{1}{2}$d.

50 A merchant at New-York buys 46 tuns of port wine, which cost him $2576; the freight thereof from port to New-York, cost $204 44 cents, the loading and unloading 26dols. 66 cents, custom $44 44 cents, the charge of the cellar $17 77 cents, and he would gain $1600 by the bargain; a gentleman comes to him and demands the price of 26 tuns of the said wine. Quere, what must he give?

Ans. $2526 $13\frac{8}{46}$cts.

51 There are 800 French crowns, at 4s. 6d. each, remitted to London, by a merchant in Paris; what is the value in pounds sterling? *Ans.* 180*l.* sterling.

52 In what time will $600 gain $50 interest, when $80 gain it in 15 years? *Ans.* 2 years.

53 Laid out $240 in serges and shalloons; the value of the shalloons was $144, and the quantity of serge 237 yards, and for every two yards of serge there were three of shalloon; how many yards of shalloon were there, and what was the value of one yard of each sort?

Ans. { 355 1/3 yards of shalloon.
{ 40cts. 5m.+ per yard.

54 What is the interest of $6374 75cts. for 2 years and 10 months at 7 per cent. per annum? *Ans.* $1264 32cts. 5m.+

55 Divide 297*l.* 2s. 3d. among 4 men, 6 boys, and give each man 3 times as much as one boy; what will each man share, and each boy?

Ans. { 16*l.* 10s. 1 1/2d. = 1 boy's share.
{ 49*l.* 10s. 4 1/2d. = 1 man's share.

NOTE.—The men have triple shares, therefore multiply the number of men by 3, and add the number of boys for an equal number of shares in the whole.

	£	s.	d.		£	s.	d.	
4×3+6=18,	297	2	3 ÷ 18 =	16	10	1 1/2	= 1 boy's share.

56 Divide 39*l.* 12s. 5d. among 4 men, 6 women, and 9 boys; give each man double to a woman, each woman double to a boy?

Ans.	£	s.	d.	
	1	1	5	—a boy's share.
	2	2	10	—a woman's share
	4	5	8	—a man's share.

57 A and B depart from the same place, and travel the same road: but A goes 5 days before B at the rate of 20 miles per day; B follows at the rate of 25 miles per day; in what time and distance will he overtake A?

Ans. { B will overtake A in 20 days,
{ and travel 500 miles.

58 Astronomers compute the earth's orbit, or track which it describes round the sun in 365 days 6 hours, to be about 596900000 miles; how far then, per minute, must we be carried through the firmament by this wonderful motion?

Ans. 1134 miles.+

59 What will 500*l.* amount to in 4 years, at 4½ per cent. per annum compound interest? Ans. 590*l.* 11s. 5½d.+

60 If I buy tallow at 35*l.* per ton, how must I sell a ton, to gain by 10 ton, as much as 1 ton cost.

Ans. 38*l.* 10s.

61 Sold goods for 300*l.* to be paid at three two months, (that is one third at two months, one third at 4 months, and one third at 6 months) what must be discounted for present payment at 4 per cent. Ans. 3*l.* 18s. 9d.+

62 Two men departed from one place; the one goes north 7 miles a day; the other south 11 miles a day; how far are they distant the 12th day after their departure?

Ans. 216 miles.

63 A has coffee, which he barters with B at 10d. per lb. more than it cost him, against tea, which stands B in 10s. per lb. but puts it to 12s. 6d. I would know how much the coffee did cost at first. Ans. 3s. 4d.

64 Reduce 256*l.* 16s. 6d. of the currency of Georgia, to that of Virginia or New England, Pennsylvania and New-York.

	£.	s.	d.	
Ans.	330	4	0+	Virginia or New England.
	412	15	1+	Pennsylvania.
	440	5	5+	New-York.

65 What is the interest of 197*l.* 10s. for 2 months at 6 per cent.? Ans. 1*l.* 19s. 6d.

66 My grandfather is 112 years of age, and my father just 64. I am not as old as my grandfather by 82 years; what is the difference in years between me and my father?

Ans. 34 years.

67 As I was beating on the forest grounds,
Up starts a hare before my two greyhounds;
The dogs, being light of foot, did fairly run
Unto her fifteen rods, just twenty one.
The distance that she started up before
Was fourscore sixteen rods just, and no more:
Now this I'd have you unto me declare,
How far they ran before they caught the hare?

Ans. 336 rods.

68 If by selling hops at 3*l.* 10s. per cwt. the planter clears 30 per cent. what was his gain per cent. when the same goods sold for 4*l.* 5s.? Ans. 57*l.* 17s. 1$\frac{5}{7}$d.

PART II.

VULGAR FRACTIONS.

Having briefly introduced Vulgar Fractions immediately after Reduction, and given some general definitions, and a few problems in order to give some general idea of Fractions, the learner is therefore requested to read those general definitions in page 67.

Vulgar Fractions are either proper, improper, compound, or mixt.

1 A *proper fraction* is when the numerator is less than the denominator, as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{17}{25}$, &c.

2 An *improper fraction*, is when the numerator is equal to, or greater than the denominator, as $\frac{4}{4}$, $\frac{7}{7}$, $\frac{8}{7}$, $\frac{12}{11}$, &c.

3 A *compound fraction*, is the fraction of a fraction, connected by the word of, as $\frac{2}{3}$ of $\frac{1}{2}$, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$, &c.

4 A *mixt number* consists of a whole number and a fraction, as $3\frac{1}{3}$, $14\frac{2}{11}$, $8\frac{7}{13}$, &c.

A whole number may be expressed like a fraction by drawing a line under it, and putting 1 for a denominator, as $8=\frac{8}{1}$, and $12=12\frac{2}{1}$, &c.

REDUCTION OF VULGAR ERACTIONS.

CASE 1.

To reduce a fraction to its lowest terms.

RULE.

Divide the greater term by the less, and that divisor by the remainder, till nothing be left; the last divisor will be the common measure; by which divide both terms, for the fraction required: or

Divide the terms by any number that will divide them both without a remainder, and divide the quotients in the same measure, and so on, till no number greater than 1 will divide them; the fraction is then at its lowest terms.

NOTE. If the common measure be 1, the fraction is already at its lowest terms. Cyphers on the right hand of *both terms may* be rejected; thus $\frac{400}{100}=\frac{4}{1}$.

EXAMPLES.

1 Reduce $\frac{72}{96}$ to its lowest terms. *Ans.* $\frac{3}{4}$.

72)96(1
72
Com. measure 24)72(3
72

$24)\frac{72}{96}=\frac{3}{4}$

or thus, $\frac{12)72}{96}=\frac{2)6}{8}=\frac{3}{4}$

2 Reduce $\frac{72}{84}$ to its lowest terms. Ans. $\frac{36}{47}$.

3 Reduce $\frac{612}{1224}$ to its lowest terms. Ans. $\frac{12}{24}$

4 Reduce $\frac{1872}{1992}$ to its lowest terms. Ans. $\frac{13}{14}$.

NOTE. For more examples in this case, see page 68.

CASE 2.

To reduce several fractions to others retaining the same value, and to have a common denominator.

RULE.

Reduce the given fractions to their lowest terms; then multiply each numerator into all the denominators but its own, for its respective numerator; and all the denominators into each other, for a common denominator.

EXAMPLES.

1 Reduce $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ to a common denominator.

Ans. $\frac{90}{120}$ $\frac{96}{120}$ $\frac{100}{120}$.

$3\times5\times6=90$
$4\times4\times6=96$ } Numerators.
$5\times4\times5=100$
$4\times5\times6=120$ Com. denominators.

2 Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$ to a common denominator.

Ans. $\frac{32}{64}$, $\frac{48}{64}$, and $\frac{40}{64}$.

3 Reduce $\frac{7}{8}$, $\frac{9}{10}$, $\frac{11}{12}$, to a common denominator.

Ans. $\frac{840}{960}$, $\frac{864}{960}$ and $\frac{880}{960}$.

4 Reduce $\frac{7}{8}$, $\frac{4}{5}$, $\frac{6}{7}$ and $\frac{6}{10}$ to a common denominator.

Ans. $\frac{735}{840}$, $\frac{672}{840}$, $\frac{504}{840}$, $\frac{720}{840}$.

5 Reduce $\frac{4}{9}$, $\frac{1}{2}$, $\frac{4}{6}$ and $\frac{5}{8}$ to a common denominator.

Ans. $\frac{192}{432}$, $\frac{216}{432}$, $\frac{288}{432}$, $\frac{270}{432}$.

CASE 3.

To reduce a mixt number to an improper fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and add the numerator to the product for a new numerator, which place over the given denominator.

EXAMPLES.

1 Reduce $12\frac{4}{9}$ to an improper fraction. Ans. $\frac{112}{9}$

$12\frac{4}{9}$

$9+4$

112 new numerator.

9 denominator.

2 Reduce $12\frac{16}{17}$ to an improper fraction. Ans. $\frac{219}{17}$.

3 Reduce $19\frac{13}{18}$ to an improper fraction. Ans. $\frac{355}{18}$.

4 Reduce $12\frac{4}{5}$ to an improper fraction. Ans. $\frac{64}{5}$.

5 Reduce $100\frac{12}{25}$ to an improper fraction. Ans. $\frac{2512}{25}$.

6 Reduce $79\frac{13}{15}$ to an improper fraction. Ans. $\frac{1198}{15}$.

CASE 4.

To reduce an improper fraction to a whole or mixed number.

RULE.

Divide the upper term by the lower.

NOTE. This case and case 3 prove each other.

EXAMPLES.

1 Reduce $\frac{219}{17}$ to its proper terms. *Ans.* $12\frac{15}{17}$.

17)219(12$\frac{15}{17}$

17

49

34

15

17

2 Reduce $^{2}\frac{41}{119}$ to its proper terms. Ans. $8\frac{5}{17}$

3 Reduce $^{3}\frac{12}{19}$ to its proper terms. Ans. $16\frac{1}{19}$

4 Reduce $^{1}\frac{36}{48}$ to its proper terms. Ans. $2\frac{30}{48}$

5 Reduce $^{9}\frac{44}{7}$ to its proper terms. Ans. $56_{4}\frac{5}{7}$

6 Reduce $^{2}\frac{4}{7}$ to its proper terms. Ans. $3\frac{3}{7}$

CASE 5.

To reduce a compound fraction to a single one.

RULE.

Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

NOTE.—Like figures in the numerators and denominators may be cancelled, and frequently others contracted by taking their aliquot parts.

EXAMPLES.

1 Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction. Ans. $\frac{24}{60}=\frac{2}{5}$

$2\times3\times4=24$
$3\times4\times5=60$

or cancelled $\frac{2}{3_{1}}$ of $\frac{3_{1}}{4_{1}}$ of $\frac{4_{1}}{5}=\frac{2}{5}$ as before.

2 Reduce $\frac{3}{7}$ of $\frac{7}{8}$ of $\frac{5}{9}$ to a single fraction. Ans. $\frac{105}{504}=\frac{5}{24}$

3 Reduce $\frac{1}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a single fraction. Ans. $\frac{135}{240}=\frac{9}{16}$

4 Reduce $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{7}{9}$ to a single fraction. *Ans.* $\frac{140}{360}=\frac{7}{18}$

5 Reduce $\frac{13}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a single fraction.
Ans. $\frac{65}{168}=\frac{5}{14}$

6 Reduce $\frac{14}{15}$ of $\frac{13}{14}$ of $\frac{21}{13}$ to a single fraction.
Ans. $\frac{3822}{2730}=\frac{14}{10}\frac{3}{5}$

CASE 6.

To reduce the fraction of one denomination to the fraction of another, but greater, retaining the same value.

RULE.

Make the fraction a compound one, by comparing it with all the denominations between it and that to which it is to be reduced; which fraction reduce to a single one.

EXAMPLES.

1 Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.

$$\frac{5}{6} \text{ of } \frac{1}{12} \text{ of } \frac{1}{20} = \frac{5}{1440} = \frac{1}{288} \text{ of a pound. } \textit{Ans.}$$

2 Reduce $\frac{3}{4}$ of a penny to the fraction of a pound. *Ans.* $\frac{1}{320}$

3 Reduce $\frac{3}{5}$ of a farthing to the fraction of a shilling. *Ans.* $\frac{1}{53\frac{1}{3}}$

4 Reduce $\frac{4}{5}$ of a cent to the fraction of a dollar. *Ans.* $\frac{1}{125}$

5 Reduce $\frac{3}{5}$ of an ounce troy, to the fraction of a pound. Ans. $\frac{3}{57}$

6 Reduce $\frac{6}{7}$ of a pound avoirdupois, to the fraction of a Cwt. Ans. $\frac{3}{175}$

7 Reduce $\frac{2}{119}$ of a pint of wine to the fraction of a hogshead. Ans. $\frac{1}{126}$ hhd.

8 Reduce $\frac{10}{11}$ of a minute to the fraction of a day. Ans. $\frac{5}{1584}$

CASE 7.

To reduce the fraction of one denomination to the fraction of another, but less, retaining the same value.

RULE.

Multiply the given numerator by the parts of the denomination between it and that to which it is to be reduced, for a new numerator, and place it over the given denominator; which reduce to its lowest terms.

NOTE. This case and case 6th prove each other.

EXAMPLES.

1 Reduce $\frac{1}{1440}$ of a pound to the fraction of a penny.

$5 \times 20 \times 12 = \frac{1200}{1440} = \frac{5}{6}$d. Ans.

2 Reduce $\frac{4}{720}$ of a pound to the fraction of a penny. Ans. $\frac{2}{3}$ d.

3 Reduce $\frac{1}{96}$ of a shilling to the fraction of a farthing. Ans. $\frac{1}{2}$ qr.

4 Reduce $\frac{1}{1000}$ of a dollar to the fraction of a cent. Ans. $\frac{1}{10}$ ct.

5 Reduce $\frac{2}{7}$ of a pound troy, to the fraction of an ounce Ans. $\frac{8}{7}$ oz.

6 Reduce $\frac{3}{392}$ of a Cwt. to the fraction of a lb. avoirdupois. Ans. $\frac{6}{7}$ lb.

7 Reduce $\frac{1}{252}$ of a hhd. to the fraction of a pint. Ans. $\frac{2}{63}$.

8 Reduce $\frac{1}{1344}$ of a day to the fraction of a minute. Ans. $\frac{10}{11}$.

CASE 8.

To reduce the value or proper quantity of a fraction to the known parts of an integer.

RULE.

Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

1 Reduce $\frac{7}{16}$ of an acre to its proper quantity. Ans. 1 rood 30 perches.

7
4

16)28(1 rood.
16

12
40

16)480(30 perches.
48

0

2 Reduce $\frac{3}{5}$ of a dollar to its proper quantity.
Ans. 60 cents.

3 Reduce $\frac{1}{4}\frac{5}{3}$ of a shilling to its proper quantity.
Ans. $5\frac{4}{13}$

4 Reduce $\frac{6}{7}$ of £5 9s. to its proper quantity.
Ans. £4 13s. $5d\frac{1}{7}$.

5 Reduce $\frac{1}{1}\frac{3}{6}$ of a ton weight to its proper quantity.
Ans. 3C. 0qr. 8lb. 9oz. 13dr. $\frac{4}{7}\frac{1}{6}$.

6 Reduce $\frac{9}{1}$ of 10C. 1qr. 12lb. to its proper quantity.
Ans. 8C. 1qr. 25lb. 1oz. 7dr. $\frac{8}{1}$.

7 Reduce $\frac{4}{7}$ of a mile to its proper quantity.
Ans. 4fur. 125yds. 2ft. 1in. $2\frac{1}{7}$b.c.

8 Reduce $\frac{4}{5}$ of a month to its proper quantity.
Ans. 3 weeks 1 day 9 hours 36 min.

NOTE. See more examples in this case, page 68.

CASE 9.

To reduce any given value, or quantity, to a fraction of any greater denomination of the same kind.

RULE.

Reduce the given quantity to the lowest denomination mentioned for a numerator; and the integer (or whole number) to the same denomination for a denominator.

NOTE. If a fraction be given, multiply both parts by the denominator thereof, and to the numerater add the numerator of the given fraction.

EXAMPLES.

1 Reduce 13s. 4d. to the fraction of a pound.

$$\frac{13s.\ 4d. = 160d.}{£1 = 20s. = 240d.} \quad \frac{2}{3} = \frac{2}{3}£. \text{ Ans.}$$

2 Reduce 10s. 6d. to the fraction of a pound. Ans. $\frac{21}{40}$£.

3 Reduce $4\frac{1}{2}$d. to the fraction of a shilling. Ans. $\frac{3}{8}$s.

4 Reduce 9oz. 2dr. $\frac{5}{7}$ to the fraction of a lb. avoirdupois. Ans. $\frac{9}{16}$lb.

5 Reduce 3qrs. 3lb. 1oz. 12dr. $\frac{4}{5}$ to the fraction of an cwt. Ans. $\frac{7}{8}$ cwt.

6 Reduce 1 rood 30 poles to the fraction of an acre. Ans. $\frac{7}{16}$ acre.

7 Reduce 2qrs. 3 nails $\frac{1}{5}$ to the fraction of an English ell. Ans. $\frac{5}{8}$ E. E.

8 Reduce 6 furlongs 16 poles, to the fraction of a mile. Ans. $\frac{4}{5}$ mile.

9 Reduce 3w. 1d. 9hrs. 36min. to the fraction of a month. Ans. $\frac{4}{5}$ month.

PROMISCUOUS EXAMPLES.

1 Reduce $\frac{354}{18}$ to its proper terms. Ans. $19\frac{2}{18}$

2 Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$ and $\frac{7}{8}$ to a common denominator. Ans. $\frac{144}{288}$, $\frac{192}{288}$, $\frac{240}{288}$ and $\frac{252}{288}$

3 Reduce 12lb. 3 oz. to the fraction of a cwt. Ans. $\frac{195}{1792}$

4 Reduce $\frac{17289}{78950}$ to its lowest terms. Ans. $\frac{1}{2}$

5 Reduce $\frac{4}{9}$ of $\frac{15}{24}$ of $\frac{10}{25}$ to a single fraction. Ans. $\frac{225}{1500}$.

6 Required the value of $\frac{3}{4}$ of a mile.
Ans. 1 fur. 28po. $3\frac{1}{7}$yds.

7 Reduce $12\frac{7}{8}$ to an improper fraction. Ans. $\frac{103}{8}$.

8 Reduce 7 h. 12 min. to the fraction of a day.
Ans. $\frac{3}{10}$ day.

9 Reduce $\frac{252}{360}$ to its lowest terms. Ans. $\frac{47}{180}$.

10 Reduce $\frac{1}{240}$ of a pound to the fraction of a penny.
Ans. $\frac{5}{6}$.

11 Reduce $\frac{4}{5}$, $2\frac{3}{4}$ and 4 to fractions of a common denominator. Ans. $\frac{32}{40}$, $\frac{78}{40}$, $\frac{160}{40}$.

12 Reduce $\frac{175}{32}$ to its equivalent or proper number.
Ans. $54\frac{17}{32}$.

13 Reduce $\frac{4}{5}$ of 5s. to the fraction of 21 shillings.
Ans. $\frac{20}{105}$.

14 Reduce $\frac{5}{8}$ of a lb. avoirdupois to the fraction of an Cwt. Ans. $\frac{5}{1008}$ cwt.

15 Reduce $\frac{2}{3}$ of $\frac{6}{7}$ of $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{7}{8}$ of $\frac{15}{16}$ to a simple fraction.
Ans. $\frac{2520}{3360} = \frac{3}{16}$

16 Reduce $\frac{3}{5}$ of a shilling to its proper quantity.
Ans. 4d. $3\frac{1}{5}$qr.

17 Reduce $13\frac{4}{5}$ to an improper fraction. Ans. $\frac{69}{5}$

18 Reduce $\frac{4}{7}$ of an cwt. to the fraction of a lb.
Ans. $\frac{4}{7}$lb.

ADDITION OF VULGAR FRACTIONS.

RULE.

1 Reduce compound fractions to single ones, mixed numbers to improper fractions, and all to a common denominator.

2 Add all the numerators together, and place the sum over the common denominator, and it will be the sum of the fraction required.

NOTE. If fractions be of different denominations, find their value separately, and add as in Compound Addition.

EXAMPLES.

1 Add $\frac{2}{3}$ and $\frac{3}{4}$ together. *Ans.* $1\frac{5}{12}$.

$2\times4=8$, $3\times3=9$ } numerators. 8, 9 } add.

$3\times4=12$ denominators. 17

$\frac{17}{12}=1\frac{5}{12}$ Ans.

2 What is the sum of $2\frac{1}{3}$, $\frac{4}{7}$, and $\frac{2}{3}$, of $\frac{3}{4}$. Ans. $3\frac{61}{120}$

First $2\frac{1}{3}=\frac{7}{3}$ and $\frac{2}{3}$ of $\frac{3}{4}=\frac{3}{6}$.

The fractions are now prepared for adding and should stand thus—$\frac{7}{3}$, $\frac{3}{6}$, $\frac{4}{7}$.

$7\times8\times5=280$
$3\times3\times5=45$ } Numerators.
$4\times3\times8=96$

421 Sum of numerators.

Then $3\times8\times5=120$ Denominator.

Which placed together stand thus $\frac{421}{120}=3\frac{61}{120}$ the *Ans.*

3 Add $\frac{2}{3}$ and $\frac{5}{7}$ together. *Ans.* $1\frac{8}{21}$.

4 Add $\frac{3}{4}$, $\frac{2}{7}$ and $\frac{5}{6}$ together. *Ans.* $1\frac{73}{84}$.

5 Add $\frac{1}{5}$, $4\frac{1}{3}$ and $\frac{2}{5}$ together. *Ans.* $4\frac{14}{15}$.

6 Add $\frac{2}{7}$ and $\frac{3}{5}$ of $\frac{3}{4}$ together. *Ans.* $\frac{41}{140}$.

7 Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of 14 together. *Ans.* $43\frac{1}{12}$.

8 Add $12\frac{1}{2}$, $3\frac{2}{3}$ and $4\frac{3}{4}$ together. *Ans.* $20\frac{1}{12}$.

9 Add $\frac{5}{8}$, $7\frac{1}{8}$ and $\frac{1}{3}$ of $\frac{3}{4}$ together. *Ans.* $8\frac{3}{8}$.

10 Add $6\frac{7}{8}$ of $\frac{9}{10}$, $\frac{4}{7}$ of $\frac{1}{2}$, and $7\frac{1}{2}$ together. *Ans.* $13\frac{2}{2}\frac{1}{4}\frac{8}{0}$.

11 Add $\frac{7}{9}$ of a pound, to $\frac{3}{10}$ of a shilling.
Ans. 15s. $10\frac{4}{15}$d.

$\frac{2}{3}$ of a £ = 15s. $6\frac{2}{3}$d.
$_{12}\frac{3}{5}$ of a s. = 0s. $3\frac{3}{5}$

Add $\frac{2}{3}$ and $\frac{3}{5}$ = $1\frac{4}{15}$.

Sum.	s.	d.
	15	6
	0	3
		$1\frac{4}{15}$

s. 15 $10\frac{4}{15}$d. Ans.

12 Add $\frac{7}{8}$ of a pound to $\frac{1}{4}$ of a shilling. Ans. 18s. 3d.

13 Add $\frac{2}{4}$ of a penny to $\frac{1}{2}$ of a pound. Ans. 2s. 3d. $1\frac{2}{3}$qr.

14 Add $\frac{1}{4}$ of a pound troy, to $_{12}\frac{7}{8}$ of an ounce. Ans. 6oz. 11dwt. 16grs.

15 Add $\frac{3}{4}$ of a mile to $_{10}\frac{7}{9}$ of a furlong. Ans. 6fur. 28p.

16 Add $\frac{1}{3}$ of a week, $\frac{1}{2}$ of a day, and $\frac{1}{2}$ of an hour together. Ans. 2d. 14h. 30min.

17 What is the sum of $\frac{2}{7}$ of 15*l*. $3\frac{3}{11}$*l*. $\frac{1}{3}$ of $\frac{5}{7}$ of $\frac{3}{5}$ of a pound, and of $\frac{1}{3}$ of a shilling. Ans. 7*l*. 17s. $6\frac{6}{7}$d.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions as in addition, then subtract the less numerator from the greater, and place the difference over the common denominator.

NOTE. When the given fractions are of different denominations, reduce them to their proper values, and then subtract as in Compound Subtraction.

EXAMPLES.

1 From $\frac{3}{4}$ take $\frac{5}{7}$.

$3\times7=21$, $5\times4=20$ } Numerators.

$4\times7=28$ Denominator.

Ans. $_{28}\frac{1}{28}$

then $\frac{21}{20}$ } subtract.

1

—Ans,

28

2 From $\frac{3}{7}$ take $\frac{2}{9}$ Ans. $\frac{1}{63}$

3 From $\frac{11}{12}$ take $\frac{2}{3}$ Ans. $\frac{1}{4}$

4 From $5\frac{3}{5}$ take $\frac{9}{10}$ Ans. $4\frac{13}{10}$

5 From $\frac{12}{20}$ take $\frac{1}{7}$ of $\frac{2}{3}$ Ans. $\frac{15}{42}$

6 From $\frac{3}{5}$ of 76 take $\frac{2}{12}$ of 21. Ans. $9\frac{7}{12}$

7 From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19. Ans. $1\frac{7}{12}$

8 From $\frac{1}{2}$ of a pound take $\frac{1}{4}$ of a shilling. Ans. 9s. 3d.

9 From $\frac{1}{2}$ of a shilling take $\frac{1}{4}$ of a penny. Ans. $5\frac{1}{2}$d.

10 From $\frac{1}{3}$ of an oz. take $\frac{7}{8}$ of a dwt. Ans. 11dwt. 3gr.

11 From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile. Ans. 1m. 2fur. 16p.

12 From 7 weeks take $9\frac{7}{10}$ days. Ans. 5w. 4d. 7h. 12m.

13 Borrowed $5\frac{1}{8}l.$ paid $\frac{2}{7}$ of $4\frac{4}{9}l.$ what remains? Ans. $4l.$ 0s. 10d.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

Reduce compound fractions to single ones, and mixed numbers to improper fractions; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

EXAMPLES.

1 Multiply $\frac{4}{5}$ by $\frac{7}{8}$ Ans. $\frac{7}{10}$

$4\times7=28$
$5\times8=40$ which reduced to its lowest terms. $=\frac{7}{10}$

2 Multiply $\frac{4}{5}$ by $\frac{3}{7}$ *Ans.* $\frac{9}{35}$

3 Multiply $\frac{4}{5}$ by $\frac{15}{16}$ *Ans.* $\frac{3}{4}$

4 Multiply $\frac{4}{7}$ by $\frac{9}{11}$ *Ans.* $\frac{4}{77}$

5 Multiply $12\frac{3}{5}$ by 7. *Ans.* $88\frac{1}{5}$

6 Multiply $4\frac{1}{2}$ by $\frac{1}{8}$ *Ans.* $\frac{9}{16}$

7 Multiply $8\frac{3}{5}$ by $9\frac{1}{4}$ *Ans.* $84\frac{1}{2}$

8 Multiply $9\frac{1}{2}$ by $\frac{1}{2}$ of $\frac{4}{5}$ *Ans.* $3\frac{9}{10}$

9 Multiply $\frac{5}{6}$ of $\frac{1}{3}$ by $\frac{1}{4}$ of $\frac{4}{5}$ of $\frac{6}{5}$ *Ans.* $\frac{1}{5}$

10 Multiply $\frac{1}{2}$ of 7 by $\frac{5}{6}$ Ans. $1\frac{1}{4}$

11 Multiply $2\frac{1}{3}$ by $1\frac{1}{7}$, and multiply the product by $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ Ans. $\frac{3}{4}$.

DIVISION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions, if necessary, then invert the divisor, and proceed as in Multiplication.

EXAMPLES.

1 Divide $\frac{4}{9}$ by $\frac{7}{8}$ Ans. $\frac{32}{63}$

$$\frac{4}{9} \div \frac{7}{8} = \frac{4}{9} \times \frac{8}{7} = \frac{32}{63}$$

2 Divide $\frac{4}{5}$ by $\frac{3}{7}$ Ans. $\frac{28}{15}$

3 Divide $\frac{13}{15}$ by $\frac{7}{9}$ Ans. $\frac{117}{105}$

4 Divide $1\frac{4}{18}$ by $\frac{7}{10}$ Ans. $1\frac{45}{63}$

5 Divide $1\frac{1}{2}$ by $4\frac{8}{10}$ Ans. $\frac{5}{16}$

6 Divide $3\frac{1}{3}$ by $9\frac{1}{2}$ Ans. $\frac{1}{3}$

7 Divide $\frac{7}{8}$ by 4 Ans. $\frac{7}{32}$

8 Divide 4 by $\frac{7}{8}$ Ans. $4\frac{4}{7}$

9 Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4. Ans. $2\frac{2}{10}$

10 Divide $\frac{5}{6}$ of 4 by $4\frac{1}{2}$ Ans. $\frac{20}{81}$

PROMISCUOUS QUESTIONS.

RULE.

1 Multiply $\frac{3}{5}$ of 8 by $\frac{7}{8}$ of 5. Ans. 21

2 Add $\frac{3}{5}$, $\frac{9}{16}$, and $\frac{7}{8}$ of $5\frac{1}{2}$ together. Ans. $6\frac{9}{16}$

3 Divide $5205\frac{1}{5}$ by $\frac{4}{7}$ of 91 Ans. $71\frac{1}{2}$

4 Subtract $\frac{17}{18}$ from $\frac{11}{2}\frac{1}{4}$ Ans. 0 remains.

5 Add $\frac{6}{7}$ of a ton, to $\frac{29}{10}$ of an Cwt.
Ans. 12cwt. 1qr. 8lb. $12\frac{8}{15}$ oz.

6 Multiply $\frac{3}{5}$, $5\frac{1}{3}$, $\frac{2}{17}$ and $\frac{14}{15}$ of $\frac{5}{16}$ Ans. $\frac{2}{5}$

7 From $\frac{1}{4}l.$ take $\frac{2}{15}$s. Ans. 4s. $1\frac{1}{2}$d.

8 Divide $\frac{1}{3}$ of $\frac{1}{4}$ of $\frac{2}{5}$ by $\frac{1}{3}$ of $\frac{1}{4}$ Ans. $\frac{8}{5}$

THE SINGLE RULE OF THREE IN VULGAR FRACTIONS.

DIRECT PROPORTION.

RULE.

Prepare the given terms if necessary and state them as in whole numbers: multiply the second and third terms together, and divide the product by the first: Or invert the first term and multiply the three together, as in Multiplication.

EXAMPLES.

1 If $\frac{2}{3}$ of a yard cost $\frac{3}{10}$ of a dollar, what cost $\frac{7}{12}$ of a yard?
Ans. 35 cents.

yd. yd. $ cancelled.

As $\frac{2}{5} : \frac{7}{15} :: \frac{3}{10}$ $\frac{5}{2} \times \frac{7}{15} \times \frac{3}{10} = \frac{7}{20}$ = 35cts.

Inverted, $\frac{5}{2} \times \frac{7}{15} \times \frac{3}{10} = \frac{105}{300}$ = 35cts.

2 If $\frac{3}{4}$ of a yard cost $\frac{5}{7}$ of a shilling, what will $\frac{5}{6}$ of a yard come to? Ans. 2s. 4d.

3 If $\frac{3}{5}$ of a yard cost $\frac{7}{15}$ of a pound, what will $\frac{7}{8}$ of a yard come to? Ans. 2s 4d.

4 If $\frac{3}{4}$ of a yard cost $\frac{7}{8}$ of a pound, what will $40\frac{3}{4}$ yards come to? Ans. 59*l.* 8s. $6\frac{1}{2}$d.

5 If $\frac{1}{4}$ of a yard of lawn cost 7s. 3d. what will $10\frac{1}{3}$ yards cost? Ans. 4*l.* 19s. 10. $2\frac{2}{3}$ qr.

6 At $12\frac{1}{3}$ cents per lb. what will $4\frac{1}{5}$lb. of cheese cost? Ans. $55\frac{2}{4}\frac{6}{5}$ cts.

7 If 2 oz. of silver cost 16s. 5d. what cost $\frac{1}{4}$ of an oz.? *Ans.* 8s. 1d. $3\frac{1}{2}$qrs.

8 If 1 dollar be worth $56\frac{3}{5}$d. what are 500 dols. worth? *Ans.* 117*l.* 18s. 4d.

9 If $1\frac{1}{2}$d bushels of apples cost $39\frac{3}{8}$ cts. what is the value of $3\frac{2}{3}$ bushels? *Ans.* \$1 01 $\frac{3}{80}$.

10 If 8lb. of sugar cost 4s. $9\frac{3}{4}$d how much is it per lb.? Ans. $7\frac{1}{2}$.

11 If $\frac{2}{3}$ of an ell English be worth $\frac{2}{3}$ of 2 dols. 28 cts. what is the value of 7 ells. *Ans.* \$17 $73\frac{1}{3}$ cts.

12 If 1 yard of broadcloth cost $15\frac{2}{3}$s. what will 4 pieces, each, containing $27\frac{3}{4}$ yards cost? Ans. 85*l.* 10s. $11\frac{1}{4}$d.

13 If $\frac{1}{2}$ lb. less by $\frac{1}{6}$ cost $13\frac{1}{2}$d. what cost 14lb. less by $\frac{2}{5}$ of 2 lb. Ans. 4*l.* 9s. $9\frac{3}{5}$.

14 If $3\frac{1}{4}$ times $3\frac{1}{2}$lb. cost $1\frac{1}{2}$ times $1\frac{1}{2}$*l.* what is the value of $\frac{2}{3}$ of $\frac{1}{2}$ of $12\frac{1}{4}$ lb. Ans. 7s. 6d.

15 If $\frac{1}{5}$ of a ship be worth \$175 35cts. what part of her may be purchased for \$601 20cts. Ans. $\frac{2}{7}$ part.

16 A person having $\frac{3}{5}$ of a coal mine sells $\frac{1}{4}$ of his share for 171*l.* what is the whole valued at? Ans. 380*l.*

17 A merchant had 5 $\frac{5}{9}$ Cwt. of sugar, at 6$\frac{3}{4}$d. per lb. which he bartered for tea at 2$\frac{1}{8}$s. per lb.; How much tea did he receive for the sugar? Ans. 43$\frac{1}{19}$lb.

INVERSE PROPORTION.

EXAMPLES.

1 How much shalloon $\frac{3}{4}$ of a yard wide, will line 4$\frac{1}{2}$ yards of cloth, 1$\frac{1}{2}$ yards wide? *Ans.* 9yds.

$$\begin{matrix} 9 \\ 4\frac{1}{2} = - \\ 2 \end{matrix} \Bigg\} \quad \begin{matrix} \text{yd.} & \text{yd.} & \text{yd.} \\ 3 & 3 & 9 \end{matrix}$$

$$\text{As} - : - : : - : 9$$

$$\begin{matrix} 2 & 4 & 2 \end{matrix}$$

$$\begin{matrix} 3 \\ 1\frac{1}{2} = - \\ 2 \end{matrix} \Bigg\}$$

Inverted.

$3 \times 4 \times 9 = 108$

$\frac{\quad}{2 \times 3 \times 2 = 12} = 9$

cancelled, $\frac{,3 \times ,4 \times ,9}{,2 \times ,3 \times ,2} = 9$

2 What quantity of shalloon, $\frac{3}{4}$ yard wide, will line 7$\frac{1}{2}$ yards of cloth, 1$\frac{1}{2}$ yards wide? Ans. 15 yds.

3 If 16 men finish a piece of work in 28$\frac{1}{3}$ days, how long will 12 men require to do the same work? *Ans.* 37$\frac{1}{3}$ days.

4 How many pieces of cloth at 20$\frac{1}{6}$dols. per piece, are equal to 240$\frac{1}{7}$ pieces at 12$\frac{1}{2}$dols. per piece?

Ans. 149$\frac{3}{8}\frac{5}{3}\frac{4}{4}$ pieces.

5 If 3 men finish a piece of work in 4$\frac{1}{2}$ hours, in how many hours will 10 men do the same work? *Ans.* 1$\frac{7}{10}$ hour.

6 When wheat is at 66cts. per bushel, if the penny loaf weighs 7 oz. what is it per bushel, when the penny loaf weighs 2$\frac{1}{4}$oz. *Ans.* $1 84cts. 8m.

DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

RULE.

Prepare the given terms when necessary, by reduction; then proceed as directed in whole numbers, or

Invert the dividing terms, and multiply the upper figures continually for the numerator, and those below for the denominator of the fractional answer.

EXAMPLES.

1 If $\frac{3}{4}$ yard of cloth $\frac{7}{8}$ yard wide, cost $\frac{2}{5}l.$ what is the value of $\frac{5}{8}$, $1\frac{1}{4}$ yards wide, of the same quantity ? Ans. 13s. 4d.

$$\left.\begin{matrix}\frac{3}{4}\text{yd.} : \frac{5}{8} \\ \frac{7}{8}\text{yd.} : \frac{7}{4}\end{matrix}\right\} :: \frac{2}{5}l.$$

$$\frac{3}{4}\times\frac{7}{8}=\frac{21}{32}$$

$$\frac{5}{8}\times\frac{7}{4}\times\frac{2}{5}=\frac{70}{160}=\frac{7}{16}$$

$$\frac{7}{16}\div\frac{21}{32}=\frac{224}{336}=\frac{2}{3}=13\text{s. } 4\text{d.}$$

Cancelled and Inverted.

$$\frac{4}{3}\times\frac{8}{7}\times\frac{5}{8}\times\frac{7}{4}\times\frac{2}{5}=\frac{2}{3}$$

2 If 600*l.* principal, gain $33\frac{1}{3}l.$ interest in $10\frac{2}{3}$ months, in what time will 100*l.* gain $6\frac{1}{4}l.$? *Ans.* 1 year.

3 If 9 students spend $10\frac{7}{9}l.$ in 18 days ; what sum will 20 students spend in 30 days ? *Ans.* 39*l.* 18s. 4d. $\frac{8}{9}$

4 If 3 men receive $8\frac{2}{10}l.$ for $19\frac{1}{2}$ days labour, how much must 20 men have for $100\frac{1}{4}$ days ? *Ans.* 305*l.* 0s. $8\frac{8}{39}$d.

5 If two men in $\frac{1}{4}$ of a year expend \$56$\frac{1}{4}$ how much will defray the expenses of 3 persons for $5\frac{1}{3}$ years at the same rate ? *Ans.* \$600.

DECIMAL FRACTIONS.

A Decimal Fraction is a fraction whose denominator is 1, with as many cyphers annexed as there are places in the numerator, and is usually expressed by writing the numerator only, with a point prefixed to it : thus $\frac{5}{10}$, $\frac{75}{100}$, $\frac{625}{1000}$, are decimal fractions, and are expressed by .5, .75, .625

A mixed number, consisting of a whole number and a decimal, as $25\frac{5}{10}$ is written thus, 25.5

As whole numbers counting from the right to the left, increase in a tenfold proportion; so decimals, counting towards the right, decrease in the same proportion, as exemplified in the following

TABLE.

Whole numbers.									Decimals.								
9	8	7	6	5	4	3	2	1.	1	2	3	4	5	6	7	8	9
Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth part.	Hundredth part.	Thousandth part.	Ten Thousandth part.	Hundred Thousandth part.	Millionth part.	Ten Millionth part.	Hundred Millionth part.	Thousand Millionth part.

NOTE. Cyphers annexed to decimals, neither increase nor decrease their value; thus, .5, .50, .500, being $\frac{5}{10}$, $\frac{50}{100}$, $\frac{500}{1000}$ are of the same value; but cyphers prefixed to decimals, decrease them in a tenfold proportion, thus, .5, .05, .005, being $\frac{5}{10}$, $\frac{5}{100}$, $\frac{5}{1000}$ are different values.

ADDITION OF DECIMALS.

RULE.

Place the given numbers according to their values; viz. units under units, tenths under tenths, &c. and add as in addition of whole numbers; observing to set the point in the sum exactly under those of the given numbers.

EXAMPLES.

.12	23.21	47.4	.15
.134	34.35	19.71	.75
.21	19.172	461.721	.92
.743	30.061	400.004	63.25
.345	9.92	7.1004	25.
.002	1.5	7.04	4.
1.554			

5 Add .15, 126.5, 650.17, 940.113 and 611.2561 together.

6 Add 2.1, 4.12, 15.4, 76.36, 120.16 and 425.04 together.

SUBTRACTION OF DECIMALS.

RULE.

Place the numbers as in addition, with the less under the greater, and subtract as in whole numbers; set the point in the remainder under those in the given numbers.

EXAMPLES.

From	125.54	14.674	719.1004.
Take	95.50803	5.91	7.121
Rem.	30.03197		

4 From 480 take 245.0075. Ans. 234.9925.

5 From .145 take .09684. Ans. .04816

6 From 270.2 take 75.4075 Ans. 194.7925

7 From an unit, or 1, subtract the millionth part of itself. Ans. .999999.

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in whole numbers, and point off in the product as many decimal places as there are in both factors.

If there are not as many places in the product as there are decimal places in the factors, prefix cyphers to supply the deficiency.

EXAMPLES.

1 Multiply .612 by 4.12

.612
4.12
1224
612
2448
2.52144

2 Multiply 1.007 by .041

1.007
.041
1007
4028
.041287

3 Multiply 37.9 by 46.5 Product 1762.35
4 Multiply 2461 by .0529 130.1869
5 Multiply 7.353 by 3.5 25.7355
6 Multiply 4.091 by .004 .016004
7 Multiply .00071 by .121 .0000859 1
8 Multiply 4.1 by 1.42 5.822
9 What is the amount of 253.5 bushels of wheat, at 1.25 dolls. per bushel. Ans. 316.875 doll. or $316 87½cts.

NOTE.—Multiplication of Decimals may be contracted thus:—Write the units place of the multiplier under that figure of the multiplicand, whose place you would reserve in the product; and dispose of the rest of the figures in a contrary order to what they are usually placed in. In multiplying, reject all the figures that are to the right hand of the multiplying digit, and set down the products, so that their right hand figures may fall in a straight line below each other; observing to increase the first figures of every line with what would arise by carrying 1 from 5 to 15, 2 from 15 to 25, &c. from the preceding figures when you begin to multiply, and the sum is the product required.

EXAMPLES.

1 Multiply 27.14986 by 92.41035, so as to retain only four decimal places in the product.

Contracted	Common way.
27.14986	27.14986
53014.29	92.41035
24434874	13574930
542997	8144958
108599	2714986
2715	10859944
81	5429972
14	24434874
2508.9280	2508.9230650510

2 Multiply 56.7534916 by 5.376928 and retain only five places of decimals in the product. Ans. 305.15943.
3 Multiply .8273 by 5.214 and retain three decimals in the product. Ans. 4.313.
4 Multiply 3.141592 by 52.7438 so as to have only four decimal places in the product. Ans. 165.6995.

DIVISION OF DECIMALS.

RULE.

Perform the operation as in integers or whole numbers.

NOTE 1.—The quotient must always have as many decimal places, as the dividend has more than the divisor: Or, in other words, there must be as many in the quotient and divisor as there are in the dividend.

2 When the dividend has not as many decimal places as the divisor, or will not contain it, annex cyphers to the right of the dividend, to supply the defect.

3 When the division is completed, and there is not a sufficient number of decimal places in the quotient, supply the deficiency by prefixing a cypher, or cyphers to it.

EXAMPLES.

1 Divide 77.4114 by 9.51

```
9.51)77.4114(8.14
     7608
     ----
     1331
      951
     ----
     3804
     3804
     ----
```

2 Divide 4.13 by 572.4.

```
572.4)4.130000(.00721+
      40068
      -----
      12320
      11448
      -----
       8720
       5724
       ----
       2996
       ----
```

3	Divide 19.25 by 38.5	Ans. .5
4	Divide 234.70525 by 64.25	3.653
5	Divide .1606 by .44	3.65
6	Divide .1606 by 4.4	.0365
7	Divide .1606 by 44	.00365

8 Divide 9. by .9 10.
9 Divide .9 by 9. .1
10 Divide 1.0012 by .075 13.34+

Division of Decimals may be contracted thus:

Take as many of the left hand figures of the divisor as will be equal to the number of integers and decimals in the quotient, and find how many times they may be had in the first figures of the dividend as usual. Let each remainder be a new dividend; and for every such dividend, leave out one figure to the right hand of the divisor, carrying for the encrease of figures cut off as in contracted Multiplication.

NOTE. When there are not so many figures in the divisor, as are required to be in the quotient, begin the operation with all the figures, as usual, and continue it till the number of figures in the divisor, and those remaining to be found in the quotient be equal, after which use the contraction.

EXAMPLES.

1 Divide 721.17562 by 2.257432. so as to leave three decimal figures in the quotient.*

	Common way.	
	2.257432)721.1756	2(319.467
2.25743)2)721.17562(319.467	677 296	
677230		
	439460	2
22574)43945	225743	2
22574		
	215717	00
2257)21371	203168	88
20317		
	10548	120
225)1054	9029	728
903		
	1518	3920
22)151	1354	4592
135		
	163	93280
2)16	158	02024
15		
	5	91256

* It will be evident that the quotient will consist of 3 figures of integers, and 3 of decimals; of course 6 figures on the left of the divisor must be taken for the first operation.

2 Divide 2508.928065051 by 92.41035, so as to have 4 decimal places in the quotient. *Ans.* 27.1498

3 Divide 12.169825 by 3.14159 so as to have 5 places of decimals in the quotient. *Ans.* 3.87377+

REDUCTION OF DECIMALS.

CASE 1.

To reduce a vulgar fraction to a decimal.

RULE.

Annex as many cyphers to the numerator as are necessary, and divide by the denominator.

Note. There must be as many decimal places in the quotient, as there are cyphers annexed to the numerator. When a compound fraction is given, first reduce it to a single one, and then to a decimal.

EXAMPLES.

1 Reduce $\frac{1}{8}$ to a decimal. *Ans.* .125.

8)1.000

.125

2 Reduce $\frac{1}{4}$ to a decimal. .25

3 Reduce $\frac{1}{2}$ to a decimal. .50

4 Reduce $\frac{3}{4}$ to a decimal. .75

5 Reduce $\frac{4}{25}$ to a decimal. .04

6 Reduce $\frac{1}{3}$ to a decimal. .33333+

7 Reduce $\frac{5}{26}$ to a decimal. .192307+

8 Reduce $\frac{11}{17}$ of $\frac{10}{13}$ to a decimal. .604395+

9 Reduce $\frac{275}{3872}$ to a decimal. .071577+

CASE. 2.

To reduce any sum or quantity to the decimal of any given denomination.

RULE.

Divide the given sum or quantity, reduced to the lowest denomination mentioned, by the proposed integer, reduced to the same denomination, and the quotient will be the decimal required. Or,

Write the given numbers from the least to the greatest, in a perpendicular column, and divide each of them by such a number as will reduce it to the next denomination, annexing the quotient to the succeeding number; the last quotient will be the decimal required.

EXAMPLES.

1 Reduce 12s. 6d. 3qrs. to the decimal of a pound.

Ans. .628125.

```
   12
  ---
  150
    4
  ---
960)603.000000(.628125 decimal.
   5760
  ----
   2700
   1920
  ----
   7800
   7680
  ----
   1200
    960
  ----
   2400
   1920
  ----
   4800
   4800
  ----
```

or thus,

```
4  | 3.00
   |-----
   | 6.7500
   |-------
20 | 12.562500
   |---------
   | .628125 decim.
```

```
£
1
20
—
20
12
—
240
4
—
960
```

2 Reduce 7s 6d to the decimal of a pound. *Ans.* .375

3 Reduce 12s. to the decimal of a pound. *Ans.* .6

4 Reduce 15s. 9d. 3qrs. to the decimal of a pound. *Ans.* .790625

5 Reduce 16s 3d. to the decimal of a pound. *Ans.* .8125

6 Reduce 3qrs. to the decimal of a shilling. *Ans.* .0625

7 Reduce 34*l.* 16s. 7½d. to a decimal.
Ans. £34.8322916+

8 Reduce 12 grains to the decimal of a lb. Troy.
Ans. .002085.+

9 Reduce 12 drams to the decimal of a lb. avoirdupois.
Ans. .046875.

10 Reduce 2qrs. 14lb. to the decimal of a Cwt.
Ans. .625

11 Reduce 2qts. 1 pint, to the decimal of a gallon.
Ans. .625

12 Reduce 2 gallons, 1 quart, to the decimal of a barrel, reckoning the barrel at 32 gal. *Ans.* .07031+

13 Reduce 3qrs. 2n. to the decimal of a yard. *Ans.* .875

14 Reduce 7 minutes to the decimal of a day.
Ans. .00486+

15 Reduce 72 days to the decimal of a year, computing the year at 365 days. *Ans.* .1972602+

16 Reduce 52 days to the decimal of a year, computing the year at 365¼ days. *Ans.* .142368+

17 Reduce ¼d. to the decimal of a shilling. *Ans.* .0625

CASE 3.

To reduce a decimal fraction to its value.

RULE.

Multiply the decimal by the number of parts in the next less denomination, and cut off as many places for a remainder, to the right hand, as there are places in the given decimal. Then multiply the remainder by the next inferior denomination, and cut off the remainder as before; and so on through all the parts of the integer, and the several denominations standing on the left hand make the answer.

EXAMPLES.

What is the value of .5724 of a pound sterling?
Ans. .11s. 5d. 1.5qr.

.5724
20

11.4480
12

5.3760
4

1.5040

2 What is the value of .461 of a dollar?
Ans. 46cts. 1m. or 461m.

3 What is the value of .75 of a pound? *Ans.* 15s.

4 What is the value of .85251 of a pound.
Ans. 17s. 0d. 2.4qrs.+

5 What is the proper quantity of .86 of a Cwt.
Ans. 3qrs 12lb. 5oz. 1.92dr.

6 What is the value of .7 of a lb. troy? *Ans.* 8oz. 8dwt.

7 What is the value of .71 of 4 oz. troy?
Ans. 2oz. 16dwt. 19.2gr.

8 What is the value of .761 of a day?
Ans. 18h. 15min. 50.4sec.

9 What is the value of .67 of a league?
Ans. 2miles, 0fur. 3poles, 1yd. 3.6in.

10 What is the proper quantity of .07 of a barrel of 32gal.
Ans. 2 gal. 1.92pt.

11 What is the quantity of .4712 of an ell English.
Ans. 2qrs. 1.424n.

12 What is the value of .3375 of an acre?
Ans. 1 rood 14 perchs.

13 What is the value of .3 of a year?
Ans. 109 days 12 hours.

NOTE. Addition and subtraction of Decimals of different denominations, may be performed, after the decimals are reduced to their proper quantities.

14 What is the sum of .48*l* and .16s. reduced to their proper quantities? *Ans.* 9s. 9. 12d.

15 What is the sum of .17 of a lb. troy, and .84 of an ounce? *Ans.* 2oz. 17dwt. 14.4grs.

16 What is the difference between .17*l*. and .7s.?
Ans. 2s. 8d. 1.6qrs.

17 What is the difference between .41 days and .16 hours? *Ans.* 9h. 40 min. 48 sec.

SINGLE RULE OF THREE DIRECT IN DECIMALS.

The operation both in Direct and Inverse proportion is the same as in whole numbers, regard being had to the right placing of the points.

EXAMPLES.

1 If 2.75 yards of cloth cost 4*l*. 13.5s. what are 12.25 yards worth? *Ans.* 20*l*. 16s. 6d.

	yds.		yds.		£ s.		£.	s.	d
As	2.75	:	12.25	::	4 13.5	:	20	16	6

2 If 1.4lb. of mace cost 14.5s. what cost 75.31lb.
Ans. 38*l*. 19s. 11d. 3.82qrs.+

3 If 1.5oz. of silver be worth 7.8s. what is the value of 9.7lb. *Ans.* 30*l*. 5s. 3d. 1.44qrs.

4 If 1.47 cwt. of sugar be worth 4.5*l*. how much is 1.7lb. worth at that rate? *Ans.* 11.15d.+

5 If 8.4lb. of tobacco cost 16s. 4.6d. what cost 3 hhds. each 4 cwt. 2qrs. 7.4lb. *Ans.* 149*l*. 12s. 3d. 2qrs.+

6 What is the value of 3 pieces of cloth, each containing 21.5yds. at 12.3s. per yard. *Ans.* 39*l*. 13s. 4.2d.+

7 If 1 pint of wine cost 1.2s. what cost 12.5 hogsheads?
Ans. 378*l*.

8 If 19 yards of linen cost 25.75 dols. what will 435.5 yards come to?
Ans. 590.217dols+or 590dols. 21cts. 7m+

9 A man bought 5.8 tons of oil, for $266, but by misfortune, lost 50.9 gallons; how must he sell the remainder per gallon to be no loser. *Ans.* 18cts. 8m.+

10 Two men bartered, A had 40.7 yards of linen, for which B gave him 25.6ells of Holland, at 4.5s. per ell. I demand the price of the linen per yard?
Ans. 2s. 9d. 3.8qr.+

11 A bought 3cwt. 1.5qr. of cloves, at 2.75s. per lb. which he afterwards sold for 60*l*. 11s. 6d. how much did he gain by the transaction? *Ans.* 8*l*. 12s.

12 A grocer bought 320.5lb. of coffee at 24½ cts. per lb.

and sold it immediately at 26.25cts. per lb. what was his whole gain, and gain per cent?

Ans. { Whole gain 5dol. 60.875cts.
{ Gain per cent. 7 dol. 14 cts. 2 m.+

INVERSE PROPORTION.

1 How long will 3 men be in performing a piece of work which will occupy 5 men 40.5 days? *Ans.* 67.5 days.

2 How many men can do as much work in .4 of a month, as 16 can do in 1.5 month? *Ans.* 60

3 What length of board 7.5 inches wide will make a square foot? *Ans.* 19.2in.

4 How much in length, of a piece of land that is 11.75 poles broad, will make an acre? *Ans.* 13.61+ poles.

5 What sum has A at interest, when it yields as much in 7.5 months, as B's 450*l.* does in 15 months? *Ans.* 900*l.*

THE DOUBLE RULE OF THREE IN DECIMALS.

Questions in this rule are performed as in whole numbers, placing the points agreeably to former directions.

EXAMPLES.

1 If 3 men receive 15.75 dollars for 4.5 days labour, what must 8 men have for 9.25 days. Ans. $86 33.3

If 3m. : 8m. / 4.5d. : 9.25d. } $15.75=86.333+ or 86dol. 33cts. 3m.+

2 If 2 persons receive 4.625s. for 1 day's labour, how much should 4 persons have for 10.5 days? *Ans.* 4*l.* 17s. 1½d.

3 If the interest of 76.5*l.* for 9.5 months be 15.24*l.* what sum will gain 6*l.* in 12.75 months? Ans. 22*l.* 8s. 9d. ⅔d.+

4 When 12 oxen graze down 16.25 acres of grass in 20 days how much of the same pasture will suffice 24 oxen 100 days? Ans. 162.5 acres.

5 If a cellar 22.5 feet long, 17.3 feet wide, and 10.25 feet deep, be dug in 2.5 days, by 6 men, working 12.3 hours a day; how many days of 8.2 hours, should 9 men take to dig another, measuring 45 feet long, 34.6 wide, and 12.3 deep? Ans. 12 days.

QUESTIONS IN REDUCTION OF VULGAR FRACTIONS.

By what name are Vulgar Fractions called ?

What is a proper fraction ?

What is an improper fraction ?

What is a compound fraction ?

What is a mixt number ?

How may a whole number be expressed like a fraction ?

How is a fraction reduced to its lowest terms ?

In reducing a fraction to its lowest terms what is the last divisor called ?

When a fraction is to be reduced to its lowest terms, and the common measure is one, what is said of the fraction ?

When cyphers are on the right hand of both terms of a fraction, what is done with them ?

How are several fractions reduced to others retaining the same value and having one common denominator ?

How is a mixt number reduced to an improper fraction ?

How is an improper fraction reduced to a whole or mixed number ?

How is a compound fraction reduced to a single one ?

How is the fraction of one denomination reduced to the fraction of another, but greater, retaining the same value ?

How is the fraction of one denomination reduced to the fraction of another, but less, retaining the same value ?

How is the value or proper quantity of a fraction reduced to the known parts of an integer ?

How is any given value or quantity reduced to the fraction of any greater denomination of the same value ?

QUESTIONS IN ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION IN VULGAR FRACTIONS.

What is the rule for adding Vulgar Fractions together ?

When the fractions are of different denominations how are they added ?

How are Vulgar Fractions subtracted ?

How are fractions of different denominations subtracted ?
How are Vulgar Fractions multiplied ?
How are Vulgar Fractions divided ?

QUESTIONS IN DIRECT, INVERSE AND DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

How are questions stated in Direct, Inverse, and Double Rule of Three in Vulgar Fractions ?

After stating sums in Single Rule of Three Direct in Vulgar Fractions how is the operation performed ?

How is the operation performed in Inverse Proportion ?

How is Double Rule of Three performed ?

QUESTIONS IN DECIMALS.

What is a decimal fraction, and how expressed ?

What is a mixed number ?

In what proportion do whole numbers and decimals increase or decrease in counting from the unit's place ?

What are said of cyphers when placed to the right hand of a decimal ?

What effect have they when placed to the left hand ?

How must whole numbers and decimals be added, and where must the point be placed in the sum or amount ?

What is the rule for doing sums in subtraction of decimals ?

How are decimals multiplied and what is the rule for placing the point in the product ?

When there are not as many figures in the product as there are decimal places in the factors what is to be done ?

What is the rule for multiplying decimals by contraction ?

How is division of decimals performed, and what is the rule for pointing off the decimals in the quotient ?

How may the division of decimals be contracted ?

QUESTIONS IN REDUCTION OF DECIMAL FRACTIONS, &c.

How is a vulgar fraction converted into a decimal?

How many decimal places must there be in the quotient?

How do we proceed when a compound fraction is given?

How is money, weight, or measures in different denominations reduced to the decimal of an integer?

How is the value of a decimal fraction found in the known parts of an integer?

What is observed in working sums in the Single and Double Rule of Three in Decimals?

ALLIGATION.

Alligation is a rule for adjusting the prices and simples of compound quantities.

CASE 1.

To find the mean price of any part of the composition, when the several quantities and their prices are given.

RULE.

As the sum of the several quantities,
Is to any part of the composition;
So is their total value,
To its value.

PROOF.

The value of the whole mixture at the mean price must agree with the total value of the several quantities at their respective prices.

EXAMPLES.

1. If 6 gallons of wine at 67 cents per gallon, 7 at 80cts. and 5 at 120 cts per gallon, be mixed together, what is one gallon of this mixture worth?

Gal.	cts.	
6	at 67	= 402
7	at 80	= 560
5	at 120	= 600
18		1562

Gal. Gal. cts. cts. m.
18 : 1 :: 1562 : 86 77 + Ans.

2 A grocer mingled several sorts of sugar as follows, viz. 75 lb. at 10cts per lb.; 80 lb. at 11cts.; 90 lb. at 13cts. and 55 lb. at 14cts. what is a pound of this mixture worth?
Ans. 11 $\frac{7}{6}$ cts.

3 If 19 bushels of wheat at 6s. per bushel: 40 bushels of rye at 4s. per bushel; and 12 bushels of barley, at 3s. per bushel, be mixed together, what will a bushel of this mixture be worth? Ans. 4s. 4$\frac{1}{4}$d. +

4 A wine merchant mixes 12 gallons of wine, at 4s. 10d. per gallon, with 24 gallons at 5s. 6d. and 16 gallons at 6s. 3$\frac{1}{4}$d. what is a gallon of this composition worth? Ans. 5s. 7d.

5 If 4 ounces of silver worth 75 cents per ounce, be melted with 8 ounces worth 60 cents per ounce, what will 1 ounce of the mixture be worth? Ans. 65cts.

CASE 2.

When the price of several simples are given, to find how much of each, at their respective rates, must be taken to make a compound or mixture at any proposed price.

RULE.

1 Write the rates of the simples under each other and set the mean rate to the left hand of them.

2 Link each rate which is less than the mean rate, with one or more that is greater.

3 Take the difference between each rate and the mean price, and set it opposite to that rate with which it is linked.

4 If only one difference stand against either rate, it will be the quantity required at that rate; but if there be several, their sums will be the quantity.

NOTE 1.—If all the given prices be greater, or less, than the mean rate, they must be linked to a cypher.

2.—Different modes of linking will produce different answers.

EXAMPLES.

1 A goldsmith would mix gold of 18 carats fine, with some of 16, 19, 22, and 24 carats fine; so that the compound may be 20 carats fine; what quantity of each must be taken?

			oz.	ca. fine.	Proof.
Mean rate 20	16	4	4 of gold.	16	16×4=64
	18	2	2 ——	18	18×2=36
	19	2	2 ——	19	Ans. 19×2=38
	22	2+1	3 ——	22	22×3=66
	24	4	4 ——	24	24×4=96
			15		300

15)300(20 car. fine.
300

2 How much rye at 4s. per bushel, barley at 3s. per bushel, and oats at 2s. per bushel, will make a mixture worth 2s. 6d. per bushel?

Ans. { 6 bush. at 4s. 6 bush. at 3s.
24 bush. at 2s.

3 A vintner would mix four sorts of wines together, of 18d. 20d. 24d. and 28d. per quart; what quantity of each must he take to sell the mixture at 22d. per quart?

Ans. 2qts. at 18d. 6 at 20d. 4 at 24d. 2 at 28d.

4 It is required to mix several sorts of wine, viz. at 9s. 15s. and 21s. per gallon, with water, that the mixture may be worth 12s. per gallon; how much of each sort must be taken?

Ans. { 3gals. at 9s. 3gals. at 15s. and 12 gals. at 21s. with 9 gals. of water.

5 A grocer has several sorts of sugar, viz. one sort at 12cts. per lb. another at 11cts. a third at 9cts. and a fourth at 8cts. per lb. how much of each sort must he take to make a mixture worth 10cts. per lb.?

1 Ans. { 2 at 12, 1 at 11, 1 at 9, 2 at 8

2 Ans. { 3 at 12, 2 at 11, 2 at 9, 3 at 8

3 Ans. { 1 at 12, 2 at 11, 2 at 9, 1 at 8

4 Ans. { 1 at 12, 3 at 11, 3 at 9, 1 at 8 } 5 Ans. { 3 at 12, 1 at 11, 3 at 9, 2 at 8 } 6 Ans. { 2 at 12, 3 at 11, 1 at 9, 3 at 8 }

7th Ans. 3lb. of each sort.

CASE 3.

When the price of all the simples, the quantity of one of them, and the mean price of the whole mixture are given, to find the several quantities of the rest.

RULE.

Link the several prices, and place their differences as in case 2; then,

As the difference opposite to the price of the given quantity,
Is to the differences respectively;
So is the given quantity,
To the several quantities required.

EXAMPLES.

1 A tobacconist having determined to mix 20 lb. of tobacco, at 15d. per lb. with other at 16d. per lb. 18d. per lb. and 22d. per lb.; how many pounds of each sort must he take to make one pound of that mixture worth 17d.?

17 { 15 — 5, 16 — 1, 18 — 1, 22 — 2 }

Ans { 5 : 1 :: 20 : 4 at 16d. per lb. × 64
5 : 1 :: 20 : 4 at 18 × 72
5 : 2 :: 20 : 8 at 22 × 176
20 at 15 × 300

Proof As 36 lb. : 612d. :: 1 : 17

2 A farmer would mix 20 bushels of wheat at 60d. per bushel, with rye at 36d. barley at 24d. and oats at 8d. per bushel; How much must he take of each sort, to make the composition worth 32d. per bushel?

Ans. 20 bush. wheat, 60 bush. of rye, 70 bush. of barley, and 10 bush. of oats.

3 How much wine at 5s.; at 5s. 6d. and at 6s. per gallon, must be mixed with 3 gallons at 4s. per gallon, so that the mixture may be worth 5s. 4d. per gallon?

Ans. 3 gals. at 5s. 6 at 5s. 6d. and 6 at 6s.

4 A grocer would mix sugars, 12cts. 10cts. and 6cts. with 20lb. at 4cts. per lb. How much of each sort must he take to make the composition worth 8cts. per lb.

Ans. 20lb. at 4cts. 10lb. at 6cts. 10lb. at 10cts. and 20lb. at 12cts.

CASE 4.

When the price of each simple, the quantity to be compounded, and the mean rate are given, to find how much of each sort will make the quantity.

RULE.

Link the several prices and place their differences as before; then,

As the sum of the differences,
Is to the difference opposite to each price,
So is the quantity to be compounded,
To the quantity required.

EXAMPLES.

1 How much sugar at 10cts. 12cts. and 15cts. per lb. will be required to make a mixture of 20lb. worth 13cts. per lb.

13	10	2	2
	12	2	2
	15	3+1	4

8 sum of difference.

	Ans.	lb.	Proof.
As 8 : 2 :: 20 :	5 at 10	=	50
8 : 4 :: 20 :	10 at 15	=	150
8 : 2 :: 20 :	5 at 12	=	60
	20 :		260 :: 1 : 13

2 A druggist having four sorts of tea, of 5s.; 6s.; 8s. and 9s. per lb. would have a composition of 87lb. worth 7s. per lb.; what quantity must there be of each?

Ans. 14½lb. at 5s.; 29lb. at 6s.; 29lb. at 8s. and 14½lb. at 9s.

3 A Goldsmith has gold of 15, 17, 20, and 22 carats fine, and would melt together of each of these so much, as to make a mass of 40 oz. of 18 carats fine; how much of each sort is necessary?

Ans. 16oz. of 15 carats, 8oz. of 17 carats, 4oz. of 20 carats, and 12oz. of 22 carats fine.

4 How many gallons of water must be mixed with wine, at 4s. per gallon, so as to fill a vessel of 80 gallons, that may be afforded at 2s. 9d. per gallon?

Ans. 25 gals. of water, with 55 gals. of wine.

NOTE.—By this case, is solved the famous question with respect to the Crown of Hiero, King of Syracuse.

PROMISCUOUS EXAMPLES.

1 If I mix gold of 18 carats fine, with that of 23 carats fine, of 19 and of 16 carats fine, so that the composition may be 20 carats fine. What quantity of each must be taken?

Ans. 3 each of 16, 18, 19, and 7 of 23.

2 A vintner mingled 15 gallons of Canary, at 8s. per gallon, with 20 gallons of Malaga, at 7s. 6d. per gallon, with 10 gallons of Lisbon, at 6s. 4d. and 24 gallons of French white wine at 4s. I demand the price of this mixture per gallon?

Ans 6s. 2d. $2\frac{46}{69}$qrs.

3 A druggist had three sorts of indigo, one sort was worth 48 cents per lb. another 60cts. and another 96cts. and out of these he made up a parcel of 21lb. at 72 cents per lb. and another parcel of 35lb. at 84cts. per lb. how much of every sort did he put in each parcel?

Ans. { 6 at 48 / 6 at 60 / 9 at 96 } per lb. Ans. { 5 at 48 / 5 at 60 / 25 at 96 } per lb.

4 A merchant would mix 3 sorts of wine of different prices, viz. one at 6s per gallon, another at 8s. a third at 11s. with 49 gallons, at 15s. per gallon, that the mixture may stand in 13s. per gallon; how much wine at 6s. 8s. and 11s. per gallon will it take

Ans. 7 gallons of each sort.

POSITION.

Position is a rule for finding an unknown number, by one or more supposed numbers. It is of two kinds Single and Double.

SINGLE POSITION.

Single Position teaches to resolve such questions as require only one supposition.

RULE.

Take any number and perform the same operations with it as are directed to be performed in the question; then
As the result of the operation,
Is to the number given;
So is the supposed number,
To the number sought.

PROOF.

Work with the answer according to directions given in the questions, and the result must equal the given number.

EXAMPLES.

1 A schoolmaster being asked how many scholars he had, said, if I had as many, half as many, and one quarter as many more I should have 88. How many had he?

Ans. 32.

Suppose he had	40
as many	40
half as many	20
¼ as many	10
	110

as 110 : 88 :: 40
40
110)3520(32
3520

Proof.
32
32
16
8
88

2 Two men, A and B having found a bag of money, disputed who should have it; A said the half, third and fourth of the money made 130 dollars: I demand how much was in the bag. Ans. 120 dollars.

3 A, B and C bought a quantity of wine for 340 dollars, of which sum A paid three times more than B, and B four times more than C; how much did each pay?

Ans. A paid 240 dolls.; B 80 dolls. and C 20 dolls.

4 A. B and C, talking of their ages, B said his age was once and a half the age of A; C said his age was twice and one tenth the age of both, and that the sum of their ages was 93: what was the age of each?

Ans. A's 12, B's 18, C's 63 years.

5 One being asked his age replied, if $\frac{3}{5}$ of the years I have lived be multiplied by 7, and $\frac{4}{7}$ of this product be divided by 3, the quotient will be 20; what was his age?

Ans. 30.

6 A gentleman bought a chaise, horse, and harness for 270 dollars, the horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness; what did he give for each?

Ans. harness 30 dols.; horse 60 dols. chaise 180 dols.

7 What sum, at 6 per cent. per annum, will amount to 360*l.* in 12 years? Ans. 500*l.*

DOUBLE POSITION.

Double Position is the method of resolving certain questions by means of two suppositions of false numbers.

RULE.

1 Take or assume any two convenient numbers, and proceed with each of them separately, according to the conditions of the question; and find how much each result is different from the result mentioned in the question, noting also whether the results are too great or too little.

2 Then multiply each of the said errors by the contrary supposition, namely, the first position by the second error, and the second position by the first error.

3 If the errors are alike, divide the difference of the products by the difference of the errors, and the quotient will be the answer.

4 But if the errors are unlike, divide the sum of the products by the sum of the errors, for the answer.

NOTE—The errors are said to be alike, when they are either both too great or both too little; and unlike, when one is too great and the other too little.

EXAMPLES.

1 B asked C how much his horse cost; C answered, that if he cost him three times as much as he did, and 15 dollars more, he would stand him in 300 dollars; what was the price of the horse? *Ans.* 95 dollars.

First Position	Second Position
90 suppose	96
3 times	3
270	288
15 Add	15
285 result	303
300 true res.	300
15 too little.	3 too much
	15
	18

90 96
X
15 3
96 90
90 270 95
135 3
285
1440 15
270
300
18)1710(95 Proof.
162
90
90

2 A, B and C would divide 100 dollars between them, so that B may have 3 dollars more than A, and C 4 dollars more than B; I demand how much each man must have.
Ans. A $30, B $33, C $37.

3 A man bequeathed 100*l.* to three of his friends, after this manner: the first must have a certain portion, the second must have twice as much as the first, wanting 3*l.*; and the third must have three times as much as the first, wanting 15*l.*; I demand how much each man must have?
Ans. the first 20*l.* 10s.; second 33*l.*; third 46*l.* 10s.

4 The head of a certain fish is 9 inches long; its tail is as long as its head and half of its body; and the length of its body is equal to the length of its head and tail: what is the whole length? Ans. 6 feet.

5 A workman was hired for 40 days upon this condition, that he should receive 20cts. for every day he wrought, and should forfeit 10cts. for every day he was idle; at settlement he received 5 dollars: How many days did he work, and how many days was he idle? Ans. Wrought 30 days, idle 10.

6 A farmer having driven his cattle to market, received for them all 130*l*; being paid for every ox 7*l*. for every cow 5*l*, and for every calf 1*l*. 10s.; there were twice as many cows as oxen, and three times as many calves as cows; how many were there of each sort?

Ans. 5 oxen, 10 cows, 30 calves.

7 A person has two horses, and a saddle worth 50*l*.; now if the saddle be put on the back of the first horse it will make his value double that of the second; but if it be put on the back of the second, it will make his value triple that of the first; what is the value of each horse?

Ans. one 30*l*. and the other 40*l*.

8 Two persons, A and B have both the same income; A saves one fifth of his every year; but B by spending 150 dollars per annum more than A, at the end of 8 years finds himself 400 dollars in debt. What was their income, and what does each spend per annum?

Ans. { Their income is 500 dollars per annum.
A spends 400 dols. and B 550 dols.

9 When first the marriage knot was ty'd
Between my wife and me,
My age was to that of my bride,
As three times three to three.
But now when ten, and half ten years
We man and wife have been,
Her age to mine exactly bears,
As eight is to sixteen;
Now tell, I pray, from what I've said
What were our ages when we wed.

Ans. { Thy age when marry'd must have been
Just forty-five: thy wife's fifteen.

INVOLUTION:

OR THE RAISING OF POWERS.

A power is the product arising from multiplying any given number into itself continually a certain number of times; thus

$2\times2=4$ the second power or square of 2
$2\times2\times2=8$ the third power or cube of 2
$2\times2\times2\times2=16$ the fourth power of 2 &c.

The number denoting the power is called the *index* or *exponent* of that power.

If two or more powers are multiplied together, then the product is that power whose index is the sum of the exponents of the factors; thus

$2\times2=4$ the square of 2; $4\times4=16=4$th power of 2; and $16\times16=256=8$th power of 2, &c.

Root.	Squares.	Cubes.	4th power.	5th power.	6th power.	7th power.	8th power.	9th power.
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

EXAMPLES.

1 What is the cube or third power of 4? *Ans.* 64.
$4\times4\times4=64$

2 What is the fifth power of 7? *Ans.* 16807.

3 What is the cube or third power of 35 ? *Ans.* 42875

4 What is the fourth power of $\frac{2}{3}$? *Ans.* $\frac{16}{81}$

5 What is the fifth power of .029 ?

Ans. 00000020511149.

6 What is the sixth power of 5.03 ?

Ans. 16196.005304479729.

EVOLUTION:

OR, THE EXTRACTING OF ROOTS.

The root of any number or power, is such a number, as being multiplied into itself a certain number of times, will produce that power. Thus, 2 is the square root of 4, because 2×2 is 4 ; and 4 is the cube root of 64, because 4×4×4=64, and so on.

THE SQUARE ROOT.

The square of a number is the product arising from that number multiplied into itself.

Extraction of the square root is the finding of such a number as being multiplied by itself will produce the number proposed.

RULE.

1 Separate the given number into periods of two figures each, beginning at the units place.

2 Subtract from the first period the greatest square it contains, setting the root of that square as a quotient figure, and doubling said root for a divisor, and bring down the second period to the remainder for a dividual.*

3 Try how often the said divisor, (with the figure used in the trial, thereto annexed) is contained in the dividual, and set this figure in both the divisor and root: then multiply and subtract as in division, and bring down the next period.

* The *dividual* is a partial dividend, or so many of the dividend figures as are taken to be divided at one time, and which produces one quotient figure.

4 Double the ascertained root for a new divisor, and repeat the process to the end.

NOTE—If there are decimals in the given number point off the periods both ways from the units place; and when the decimals do not consist of an even number of figures, annex a cypher. The root must have as many whole numbers and decimal figures as there are periods of each in the given number.

PROOF.

Square the root, adding in the *remainder*, if any, and the result will equal the given number.

EXAMPLES.

1 What is the square root of 30138.696025 ?

```
                . . . . . .
1 )30138.696025(173.605
1  1
 ---  ---
27)201
 7  189
 ---  ---
343)1238
   3  1029
 ---  ---
3466)20969
    6  20796
 ---  ---
347205)1736025
          1736025
```

2	What is the square root of 1296 ?	*Ans.* 36.
3	What is the square root of 5499025 ?	2345
4	What is the square root of 74770609 ?	8647
5	What is the square root of 368863 ?	607.34092+
6	What is the square root of 2.2710957 ?	1.50701+
7	What is the square root of 10. ?	3.162277+
8	What is the square root of .0003272481 ?	.01809
9	What is the square root of 9712.693809 ?	98.553

TO EXTRACT THE SQUARE ROOT OF A VULGAR FRACTION.

RULE.

Reduce the fraction to its lowest terms, then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

NOTE.—If the fraction be a surd, that is one whose root can never be exactly found, reduce it to a decimal, and extract the root therefrom.

EXAMPLES.

1 What is the square root of $\frac{7056}{12100}$?	*Ans.* $\frac{7}{8}$
2 What is the square root of $\frac{2704}{4225}$?	$\frac{4}{5}$
3 What is the square root of $\frac{478}{845}$?	.93309+
4 What is the square root of $\frac{3168}{6193}$?	.71928+

TO EXTRACT THE SQUARE ROOT OF A MIXED NUMBER.

RULE.

Reduce the mixed number to an improper fraction, and proceed as in the foregoing examples; or

Reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

EXAMPLES.

1 What is the square root of $37\frac{36}{49}$?	*Ans.* $6\frac{1}{7}$
2 What is the square root of $17\frac{16}{25}$?	$4\frac{1}{5}$
3 What is the square root of $85\frac{1}{4}$?	9.27+
4 What is the square root of $7\frac{9}{11}$?	2.796+

APPLICATION.

1 A certain pavement is made exactly square, each side of which contains 97 feet, I demand how many square feet are contained therein? *Ans.* 9409.

2 A certain square pavement contains 20736 square stones, all of the same size, what number is contained in one of its sides? *Ans.* 144.

3 A certain number of men gave 30s. 1d. for a charitable purpose; each man gave as many pence as there were men; how many men were there? *Ans.* 19 men.

4 If 484 trees be planted in a square orchard, how many must be in a row each way? *Ans.* 22

NOTE—The square of the longest side of a right angled triangle is equal to the sum of the squares of the other two sides: and consequently the difference of the square of the longest, and either of the other, is the square of the remaining one.

The wall of a certain fortress is 17 feet high, which is surrounded by a ditch 20 feet in breadth; how long must a ladder be to reach from the outside of the ditch to the top of the wall? *Ans.* 26.24+feet.

6 A line of 36 yards long will exactly reach from the top of a fort to the opposite bank of a river, known to be 24 yards broad; the height of the wall is required?

Ans. 26.83+yards.

7 Suppose a ladder 60 feet long, be so planted as to reach a window 37 feet from the ground on one side of the street, and without moving it at the foot, will reach a window 23 feet high on the other side; what was the breadth of the street?

Ans. 102.64+feet.

8 If a pipe whose diameter is 1.5 inches, fill a cistern in 5 hours; in what time will a pipe, whose diameter is 3.5 inches fill the same? *Ans.* 54 min. 36 sec.

$1.5 \times 1.5 = 2.25$; and $3.5 \times 3.5 = 12.25$; Then as
2.25 : 5 :: 12.25 = .91 hour inversely = 54m. 36sec.

9 Admit a leaden pipe $\frac{1}{4}$ inch diameter, will fill a cistern in 3 hours; I demand the diameter of another pipe, which will fill the same cistern in one hour.

Ans. 1.3 inches, nearly.

THE CUBE ROOT.

The Cube of a number is the product of that number multiplied into its square.

Extraction of the cube root is the finding such a number, as being multiplied into its square, will produce the number proposed.

RULE.

1 Separate the given number into periods of three figures each, beginning at the units place. These periods will denote the number of figures the required root will contain.

2 Find the greatest root contained in the left hand period, which place to the right of the given number, subtract the cube of this root from the said period, and to the remainder bring down the next period for a dividual.

3 Square the root and multiply the square by 3 for a defective divisor.

4 Reserve mentally the units and tens of the dividual and try how often the defective divisor is contained in the rest: place the result of this trial to the root, and its square to the right of said divisor, supplying the place of tens with a cypher, if the square be less than ten.

5 Multiply the other figure or figures in the root by this last and by 30 which product add to the defective divisor and call it the complete divisor.

6 Multiply and subtract as in simple division, and bring down the next period for a new dividual, for which find a divisor as before, and so proceed with every period.

NOTE. When there are decimals in the given number separate the periods both ways from the units place, annexing as many cyphers to the decimal as may be deemed necessary. The root must consist of as many whole numbers and decimal figures as there are periods of each in the given number.

PROOF.

Involve the root to the third power, adding the remainder, if any, to the result.

EXAMPLES.

1 What is the Cube root of 444194.947?

Ans.

444194.947(76.3
343

{ Defect. div. & sqr. of 6=14736)101194
{ + 1260=complete div. 15996) 95976

{ Defect. div. & sqr. of 3=1732809) 5218947
{ +6840=complete divis. 1739649) 5218947

0

7×7×3=147 def. div.
7×6×30=1260 to complete the divisor.
76×76×3=17328 def. divis.
76×3×30=6840 to complete the divisor.

2	What is the cube root of 34328125 ?	*Ans.* 325
3	What is the cube root of 99252.847 ?	46.3
4	What is the cube root of 259694072 ?	638
5	What is the cube root of 22069810125 ?	2805
6	What is the cube root of 171.46776406 ?	5.555+
7	What is the cube root of .001906624 ?	.124

NOTE 1. The cube root of a vulgar fraction is found by reducing it to its lowest terms, and extracting the root of the numerator for a new numerator, and of the denominator for a new denominator. If it be a surd, extract the root of its equivalent decimal.

2. A mixed number may be reduced to an improper fraction or a decimal, and the root thereof extracted.

1	What is the cube root of $\frac{64}{1000}$?	*Ans.* $\frac{4}{10}$
2	What is the cube root of $\frac{35}{11}\frac{5}{5}$?	$\frac{2}{5}$
3	What is the cube root of $12\frac{19}{27}$?	$2\frac{1}{3}$

SURDS.

4	What is the cube root of $\frac{4}{9}$?	*Ans.* .763+
5	What is the cube root of $7\frac{1}{2}$?	1.93+
6	What is the cube root of $9\frac{1}{6}$?	2.092+

APPLICATION.

1 Suppose a cellar to be dug, that shall be 12 feet every way, in length, breadth, and depth; how many solid feet of earth must be taken out to complete the same?

Ans. 1728.

2 The content of a cubical piece of timber is 103823 solid inches, how many inches is it each way? *Ans.* 47.

3 A stone of a cubical form contains 474552 solid inches, what is the superficial content of one of its sides?

Ans. 6084.

4 A merchant laid out 691*l.* 4*s.* in cloths, but forgot the number of pieces purchased, also how many yards were in each piece, and what they cost him per yard; but remembers that they cost him as many shillings per yard as there were yards in each piece, and that there was just as many pieces: query, the number purchased? *Ans.* 24.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

1 Point the given number into periods agreeably to the required root.

2 Find the first figure of the root by the table of powers, or by trial; subtract its power from the left hand period, and to the remainder bring down the first figure in the next period for a dividual.

3 Involve the root to the next inferior power to that which is given, and multiply it by the number denoting the given power, for a divisor; by which find a second figure of the root.

4 Involve the whole ascertained root to the given power, and subtract it from the first and second periods. Bring down the first figure of the next period to the remainder for a new dividend; to which, find a new divisor, as before, and so proceed.

Note. The roots of the 4th, 6th, 8th, 9th, and 12th powers, may be obtained more readily, thus:

For the 4th root take the square root of the square root,
For the 6th take the square root of the cube root,
For the 8th take the square root of the 4th root,
For the 9th take the cube root of the cube root,
For the 12th take the cube root of the 4th root.

EXAMPLES.

1 What is the 5th root of 916132832?

916132832(62 *Ans.*
7776

6480)13853

916132832
916132832

$6\times6\times6\times6\times6=7776$
$6\times6\times6\times6\times5=6480$

$62\times62\times62\times62\times62=916132832$

2 What is the Biquadrate-root or 4th power of 56249134561? *Ans.* 487.

3 What is the 6th power of 782757789696? *Ans.* 96.

4 What is the 7th root of 194754273881? *Ans.* 41

5 What is the ninth root of 1352605460594688? *Ans.* 48

ARITHMETICAL PROGRESSION.

Any rank of numbers, increasing or decreasing by a common difference, is said to be in Arithmetical Progression: as

2, 4, 6, 8, 10, &c is an ascending arithmetical series,
6, 5, 4, 3, 2, 1, is a descending arithmetical series.

The numbers which form the series, are called the terms of progression. The first and last terms of which are called the extremes.

NOTE. In any series of numbers in Arithmetical Progression, the sum of the two extremes is equal to the sum of any two equally distant from them; as in the latter of the above series, $6+1=4+3$, and $5+2$.

When the number of terms is odd, the double of the middle term is equal to the sum of the two extremes, or any two terms equally distant from the middle term; as in the former of the foregoing series $6+2=2+10$, and $=4+8$

In Arithmetical Progression five things are to be observed, viz.

First, the first term;
Secondly, the last term;
Thirdly, the number of terms;
Fourthly, the common difference;
Fifthly, the sum of all the terms;

Any three of which being given, the other two may be found.

CASE 1.

The first term, common difference, and number of terms given to find the last term, and sum of all the terms.

RULE.

First Multiply the number of terms, less 1, by the common difference, and to the product add the first term, the sum is the last term.

Second. Multiply the sum of the two extremes by the number of terms, and half the product will be the sum of all the terms.

EXAMPLES.

1 Bought 19 yards of shalloon, at 1d. for the first yard, 3d. for the second, 5d. for the third, &c. increasing 2d. for every yard; what did they amount to?

Ans. £1 10s. 1d.

19	number of terms	37 } two extremes 1 }
1		
18	num. of terms, less 1	38
2	common difference	19 number of terms
36		342
1	first term	38
37	last term	2)722
		12)361 sum of all the terms in pence
		2(0)3(0 1
		£1 10s 1d. Ans.

2 How many strokes does the hammer of a clock strike in twelve hours. *Ans.* 78 times.

3 Sixteen persons bestowed charity to a poor man, the first gave 5d.; the second 9d.; and so on in arithmetical progression; what did the last person give, and what sum did the indigent person receive?

Ans. the last gave 5s. 5d.; sum received 2*l.* 6s. 8d.

4 A merchant sold 100 yards of cloth; for the first yard he received 1s.; for the second 2s.; for the third, 3s. &c.; what sum did he receive? Ans. 252*l.* 10s.

5 If 100 stones be laid two yards distant from each other in a right line, and a basket placed two yards from the first stone; what distance must a person travel, to gather them singly into the basket? Ans. 11m. 3fur. 80yds.

6 A merchant sold 1000 yards of linen, at 2 pins for the first yard, 4 for the second, and 6 for the third, &c. increasing 2 pins every yard; how much did the linen produce when the pins were afterwards sold at 12 for a farthing?

Ans. 86*l.* 17s. 10d.+

CASE. 2.

When the two extremes and number of terms are given, to find the common difference.

RULE.

Divide the difference of the extremes by the number of terms, less one; the quotient will be the common difference.

EXAMPLES.

1 Admit a debt to be discharged at 16 several payments in arithmetical progression: the first to be 14*l.* the last 100*l.* what is the common difference, and what each payment, and the whole debt.

£100 } Extremes.
14 }

16—1=15)86(5 : 14 : 8 common difference.
75

11
20

15)220(14
15

70
60

10
12

15)120(8
120

£.	s.	d.	
5	14	8	
14	0	0	=first payment.
19	14	8	=second
25	9	4	=third, &c.

14×100×8=912 the whole debt.

2 There are 21 persons, whose ages are equally distant from each other; the youngest is 20 years old and the eldest 60; what is the common difference of their ages, and the age of each person? *Ans.* common difference 2 years.

20 the age of the first person.
20+2=22 of the second.
22+2=24 of the third, &c.

3 A man had 10 sons, whose several ages differed alike; the youngest was 3 years old, and the eldest 48; what was the common difference of their ages? *Ans.* 5 years.

4 A person is to travel from New-York to a certain place in 16 days and to go but 4 miles the first day increasing every day by an equal excess, so that the last day's journey may be 79 miles, what is the common difference, and what the whole distance?

Ans. { Common difference 5 miles.
Distance 664 miles.

GEOMETRICAL PROGRESSION.

Geometrical Progression is a series of numbers increasing by a common multiplier, or decreasing by a common divisor; as 2, 4, 8, 16, 32, &c. and 32, 16, 8, 4, 2.

The number by which the series increase or decrease is called the ratio.

The sum of the series is found by this

RULE.

Raise the ratio to a power denoted by the number of terms subtract 1, and multiply the remainder by the 1st term: this product divided by the ratio, less 1, gives the sum of the progression.

EXAMPLES.

1 A thrasher wrought 20 days, and received for the first day's labour 4 grains of wheat; for the second, 12, for the third, 36: how much did his wages amount to, allowing 7680 grains to make a pint and the whole to be sold for one dollar twenty five cents per bushel?

NOTE. The first term in this question is 4, the ratio 3, the number of terms 20; therefore raise the ratio to the 20th power.

	1st power.	2d power.	3d power.	4th power.	5th power.	
Ratio.	3,	9,	27,	81,	243	
					243	
					729	
				972		
				486		
				59049		tenth power.
				59049		
				531441		
			236196			
			531441			
			295245			
			3486784401			twentieth power.
				1		
			3486784400			
				4		first term.
Ratio less one.			2)13947137600			
			7680)6973568800			sum of the series.
			64)908016			pints.
			14187			bushels.
			125			cents, value of 1 bushel.
			70935			
			28374			
			14187			
			$17733,75			cts. *Ans.*

2 Bought 30 bushels of wheat at 2d. for the first bushel, 4d. for the second, 8d for the third, &c. what does the whole amount to, and what is the price per bushel on an average?

Ans. { 8947848*l.* 10s. 6d. Amount.
2982616*l.* 12s. 4d. per bushel.

3 What sum would purchase a horse with 4 shoes, and 8 nails in each shoe, at one farthing for the first nail, a half-penny for the second, a penny for the third, &c. doubling to the last? *Ans.* 4473924*l.* 5s. 3d. $\frac{3}{4}$

4 Admit a goldsmith sold one lb. of gold, at one farthing for the first ounce, a penny for the second, 4d. for the third, &c. in a quadruple proportion; what did it amount to? and what did he gain by it supposing it cost him 4*l.* per ounce?

Ans. { 5825*l.* 8s. 5$\frac{1}{4}$d. sold for.
5777*l.* 8s. 5$\frac{1}{4}$d. gained.

5 A certain person married his daughter on a new-year's day, and gave her an English guinea towards her portion, promising to double it on the first day of every month for one year. What was her portion in Federal money?

Ans. $19110.

NOTE—$ = 4s. 6d.

6 If the posterity of Noah, which consisted of six persons at the flood, encreased so as to double their number in 20 years; how many inhabitants would there be in the world two years before the death of Shem, who lived 502 years after the flood? *Ans.* 201326586.

7 A grain of wheat being sown, produces 7 grains, which are sown again and yield the same increase: Required how much it will amount to in 12 years, if the whole crop be always sown and yield the same increase; and how many bushels allowing as before for the number of grains in a pint.

Ans. { 2306881200 grains.
4693 bush. rejecting remainders.

8 Sold 30 yards of velvet, at 2 pins for the first yard, 6 for the second, 18 for the third, &c. and these disposed of at one farthing per 100, how much did the velvet amount to? And whether did the seller gain or lose, and how much, supposing the prime cost of the velvet at 50*l.* per yard?

Ans. { 2144699292*l.* 13s. 0$\frac{1}{2}$d. amount.
2144697702*l.* 13s. 0$\frac{1}{2}$d. gained.

PERMUTATION.

Permutation is a rule for finding how many different ways any given number of things may be varied in their position.

RULE.

Multiply all the terms of the natural series continually from 1 to the given number inclusive; the last product will be the answer required.

EXAMPLES.

1 How many changes can be made of the three first letters of the alphabet?

$1\times2\times3=6$ *Ans.*

Proof.

1	a b c
2	a c b
3	b a c
4	b c a
5	c b a
6	c a b

2 How many different positions can 6 persons place themselves in at table? *Ans.* 720.

3 How many changes may be rang on 9 bells?
Ans. 362880.

4 Seven gentlemen met at an inn, and were so well pleased with their host, and with each other, that they agreed to tarry so long as they, together with their host, could sit every day in a different position at dinner; how long must they have staid at said inn, to have fulfilled their agreement? *Ans.* $110\frac{170}{365}$ years.

COMBINATION.

Combination is a rule for discovering how many different ways a less number of things may be combined out of a greater; thus, out of the letters a, b, c, are three different combinations of two: viz. ab, ac, bc.

RULE.

Take a series proceeding from and increasing by a unit, up to the number to be combined; and another series of as many places decreasing by a unit, from the number out of which the combinations are to be made, multiply the former continually for a divisor, and the latter for a dividend, the quotient will be the answer.

NOTE—Sums in this rule may be very much shortened by contraction.

EXAMPLES.

1. How many combinations of 5 letters in 10 ?

Ans. 252.

$$\frac{10\times9\times8\times7\times6}{1\times2\times3\times4\times5}=252$$

Contracted.

$$\frac{\overset{2}{10}\times9\times\overset{2}{8}\times7\times\overset{2}{6}}{1\times\cancel{2}\times\cancel{3}\times\cancel{4}\times5}=252$$

2 How many combinations can be made of 6 letters out of 10 ? *Ans.* 210.

3 What is the value of as many different dozens as may be chosen out of 24, at 1d. per dozen ?

Ans. 11267*l*. 6s. 4d.

QUESTIONS IN ALLIGATION.

What is Alligation ?

When the several quantities and their prices are given, how is the mean price of any part of the composition found ?

How are the simples with the mean rate placed in order to be linked ?

How should the rates be linked with each other ?

How is the difference between each rate and the mean rate set down ?

What is the difference thus found ?

When all the given rates are greater or less than the mean rate, how must they be linked ?

When the questions are differently linked what do they produce ?

When the price of all the simples, the quantity of one of them, and the mean price of the whole mixture are given, how are the several quantites of the rest found ?

When the price of each simple, the quantity to be compounded, and the mean rate are given, how do we find how much of each sort will make the quantity ?

QUESTIONS IN POSITION.

What is Position ?

How many kinds of position are there ?

What is single position ?

What is the rule for working sums in single position ?

What is double position ?

What is the first step taken in double position ?

What is done with the positions and their errors ?

When the errors are alike how is the answer found ?

And how is it found when the errors are unlike ?

What is understood by the errors being alike or unlike ?

QUESTIONS IN THE SQUARE ROOT.

What is the Involution or raising of powers ?

What is the index or exponent of a power ?

What is understood by the root of any power ?

What is the square of a number ?
In extracting the Square Root what is first done ?
What then are the several steps taken to find the Root ?
What is the dividual ?
When there are decimals in the given number, how are the periods pointed off ?
What proportion is there between the number of figures in the quotient, and the number in the dividend ?
How is the Square Root proved ?
How is the Square Root of a Vulgar Fraction extracted ?
What is a Surd ?
How is the Square Root of a Surd extracted ?
How is the Square Root of a mixed number extracted ?

QUESTIONS IN THE CUBE ROOT.

What is the cube of a number ?
What is understood by the cube root of a number ?
What is first done in extracting the cube root ? and then what are the different steps taken ?
How is the given number separated into periods when part is decimals ?
How many figures must there be in the root ?
How is the cube root proved ?
How is the cube root of a vulgar fraction found ?
How is a vulgar fraction extracted when it is a surd ?
How is the root of a mixed number extracted ?

COMPOUND INTEREST, BY DECIMALS.

The ratio in compound interest is the amount of one pound or dollar for one year, which is thus found:

As 100 : 1 :: 105 : 1.05 As 100 : 1 :: 105.5 : 1.055.

The principal, time, and rate given, to find the amount, or interest.

RULE.

Multiply the principal by the ratio involved to the time, and the product will be the amount; from which subtract the principal, for the compound interest.

EXAMPLES.

1 What will 225*l.* amount to in 3 years at 5 per cent. per annum.

1.05 × 1.05 × 1.05 = 1.157625 raised to the third power; then, 1.157625 × 225 = 260*l.* 9s. 3d. 3qr. the *Ans.*

2 What is the amount of 760*l.* 10s. for 4 years at 4 per cent per annum? *Ans.* 889*l.* 13s. 6½d.

3 What is the compound interest of 509*l.* for 4 years at 5 per cent. per annum? *Ans.* 107*l.* 15s. 0¼d.

4 What will 480*l.* amount to in 6 years at 5 per cent per annum? *Ans.* 643*l.* 4s. 11d.

DISCOUNT.

AT COMPOUND INTEREST.

The amount, rate and time given to find the principal.

RULE.

Divide the amount by the ratio involved to the time.

EXAMPLES.

1 What principal must be put to interest to amount to 260*l.* 9s. 3d. 3qrs. in 3 years, at 5 per cent. per annum?

260*l.* 9s. 3d. 3qrs. = 260.465625*l.*

1.05 × 1.05 × 1.05 = 1.157625 ratio raised to the third power.

1.157625)260.465625(225*l.* Ans.

2 What principal will amount to 547*l.* 9s. 10d. 2.0528qrs. in 5 years, at 4 per cent per annum. *Ans.* 450*l.*

3 What principal will amount to 610*l.* 8s. 2d. 3.808qrs. 4 years, at 5½ per cent. per annum? *Ans.* 500*l.*

DUODECIMALS.

Duodecimals are fractions of a foot, or of an inch, or parts of an inch, &c. having 12 for their denominator.

The denominations are foot, inch, second, thirds and fourths.

12 fourths ''''	make 1 third'''.
12 thirds	1 second''.
12 seconds	1 inch I.
12 inches	1 foot ft.

Addition and subtraction in duodecimals are performed the same manner as in compound addition and subtraction.

MULTIPLICATION OF DUODECIMALS.

CASE 1.

When the feet of the multiplier do not exceed 12.

RULE.

Set the feet of the multiplier under the lowest denomination of the multiplicand, as in the following example; these multiply as in compound multiplication by each denomination of the multiplier separately, observing to place the right hand figure, or number, of each product, under that denomination of the multiplier by which it is produced.

NOTE. If there are no feet in the multiplier supply their place with a cypher; and in like manner supply the place of any other denomination between the highest and lowest.

2 Feet multiplied by feet, give feet.
Feet multiplied by inches, give inches.
Feet multiplied by second's, give seconds.
Inches multiplied by inches, give seconds.
Inches multiplied by seconds, give thirds.
Seconds multiplied by seconds, give fourths.

EXAMPLES.

1 Multiply 10 Ft. 6 I. by 4 Ft. 6 In.

Ft. In.	In.	Or thus,	F. I.	Or decimally.
10 : 6	6 | ½ |	10 : 6	10 : 6 =	10.5
4 : 6		4 : 6	4 : 6 =	4.5
5 : 3 : 0		42 : 0		525
42 : 0		5 : 3		420
47 : 3 : 0		47 : 3		47.25

		Ft. I. ″	Ft. In. ″	Ft. I. ″
2	Multiply	9 ; 7 ; 0	by 3 ; 6 ; 0	*Ans.* 33 ; 6 ; 6
3	———	3 ; 11 ; 0	by 9 ; 5 ; 0	36 ; 10 ; 7
4	———	8 ; 6 ; 9	by 7 ; 3 ; 8	62 ; 6 ; 7 ; 9
5	———	28 ; 10 ; 6	by 3 ; 2 ; 4	92 ; 2 ; 10 ; 6

CASE 2.

When the feet of the multiplier exceed 12.

RULE.

Multiply by the feet of the multiplier as in compound multiplication, and take parts for the inches, &c.

EXAMPLES.

Multiply 311 4 7 ″ by 36 7 5 ″

6 × 6 = 36

	1868	3	6		
			6		
I. 6 = ½	11209	9	0		
1 = ⅙	155	8	3	6	
″ 4 = ⅓	25	9	8	7	
1 = ¼	8	7	2	10	4
	2	1	9	8	7
Product.	11402	0	0	7	11

		Ft. I. ″	Ft. I. ″	F. I. ″ ‴
2	Multiply	76 7 0	by 19 10 0	*Ans.* 1518 10 10 0
3	———	84 3 0	by 95 2 0	8017 9 6 0 ‴ ‴
4	———	84 7 11	by 76 3 9	6460 7 1 8 3

APPLICATION.

NOTE.—Divide the square feet by 9, and the quotient will be square yards.

1 What will the plastering of a ceiling at 10d. per yard, come to, supposing the length 21 feet 8 inches, and the breadth 14 feet 10 inches? *Ans.* 1*l.* 9s. 9d.

2 What will the paving of a court-yard come to, at $4\frac{3}{4}$d. per yard, the length being 58 feet 6 inches, and the breadth 54 feet 9 inches? *Ans.* 7*l.* 0s. 10d.

3 Suppose the dimensions of a load of bark or wood to be 7 feet 6 inches long, 3 feet 3 inches wide, and 1 foot 10 inches high; what is the solid content?

Ans. 44 Ft. 8in. 3″.

PROMISCUOUS QUESTIONS TO EXERCISE THE LEARNER IN THE FOREGOING RULES.

1 There are in three bags, the sum of 1468 dollars, viz. in the first bag 461 dol. in the second 581 dol. I demand what is in the third bag? *Ans.* 426 dollars.

2 What difference is there between twice five and twenty and twice twenty five? *Ans.* 20.

3 If 100*l.* principal gain 5*l.* interest in 12 months, what principal will gain 20*l.* in 8 months. Ans. 600*l.*

4 How many yards of cloth at 17s. 6d. per yard, can I have for 13cwt. 2qr. of wool, at 14d. per lb.

Ans. 100 yards, $3\frac{1}{2}$qrs.

5 To how much amounts the order, for which a factor, at the rate of $2\frac{1}{2}$ per cent. per annum receives 22*l.* 10s.?

Ans. 900*l.*

6 Jacob by contract was to serve Laban for his two daughters 14 years; and when he had accomplished 11 years, 11 months 11 weeks, 11 days, 11 hours, and 11 minutes; how long had he to serve?

Ans. 1y. 11 m. 3 w. 2 d. 12 h. 49 m.

7 If a man leave 6509 dollars to his wife and two sons; thus to his wife $\frac{1}{3}$; to his elder son $\frac{2}{3}$ of the remainder, and his other son the rest; what was the share of each?

Ans. { His wife \$2440 87½ cts.
Elder son \$2440 87½ cts.
Other son \$1627 25 cts.

8 There are 7 chests of drawers, in each of which there are 18 drawers, and in each of these there are six divisions, in each of which is 16*l.* 6s. 8d.; how much money is there in the whole? Ans. 12343*l.*

9 If $\frac{2}{3}$ of an ounce cost $\frac{7}{8}$ of a shilling, what will $\frac{5}{6}$ of a lb. cost? Ans. 17s. 6d.

10 If $\frac{5}{6}$ of a gallon cost $\frac{5}{7}$ of a pound what will $\frac{5}{9}$ of a tun cost? Ans. 105*l.*

11 A young man received 210*l.* which was $\frac{3}{5}$ of his elder brother's portion; now three times the eldest brother's portion was half of the father's estate; how much was the estate worth? Ans. 1890*l.*

12 A man had 12 sons; the youngest was 3 years old, and the eldest 58; they increased in arithmetical progression, what was the common difference of their ages? Ans. 5 years.

13 If I buy a yard of cloth for 14s. 6d. and sell it for 18s. 9d. what do I gain per cent.? Ans. 15*l.* 10s. $4\frac{34}{171}$d.

14 How many dollars are equal to 980 French crowns? Ans. $1078

15 Bought 27 bags of ginger each weighing gross $84\frac{1}{2}$lb. tare $1\frac{1}{8}$lb. per bag, tret 4 lb. per 104 lb.; what does the whole (neat weight) come to, at $8\frac{1}{2}$d. per lb.? Ans. 76*l.* 13s. $2\frac{1}{2}$d.

16 If the human heart beat 70 times in a minute, and each pulsation transmit 4 oz. Avoirdupois of blood, and the whole blood be $\frac{1}{16}$ part of the weight of the body; in what time will the whole blood of a man, whose weight is 140 lb. circulate through the heart? Ans. in 24 sec.

17 Divide 1200 acres of land among A, B, and C, so that B may have 100 more than A, and C 64 more than B. Ans. A 312, B 412, and C 476.

18 A person dying, left his widow 1780*l.* and 1250*l.* to each of his 4 children; he had been $25\frac{1}{2}$ years in trade and had cleared (at an average) 126*l.* a year; what had he to begin with? Ans. 3567*l.*

19 How many trees may be planted on an acre of ground at 6 feet distance? Ans. 1210.

20 If a cow yield 20 quarts of milk in a day for 240 days, and 25 quarts make 1 lb. butter, how many lbs. butter will be obtained in the season, and what does the value come to at 15cts. per lb. Ans. 192lb. $28 60cts.

21 A grocer buys sugar at 3*l.* 15s. per cwt. at what rate per cwt. must he sell it in order to gain 5 per cent. and at what rate per lb. in order to gain 10 per cent.? Ans. 3*l.* 18s. 9d. and 8d. $3\frac{2}{14}$ qrs.

22 Admitting the Hudson river to be 1000 feet broad, and 10 feet deep, and to run at the rate of 4 miles in an hour, in what time will it discharge a cubic mile of water (reckoning 5000 feet to the mile) into the sea?

Ans. 26 days, 1 hour.

23 If A can do a piece of work alone in 7 days, and B in 12, set them both about it together, in what time will they finish it? Ans. $4\frac{1}{19}$

NOTE. In questions of this kind, suppose the work to consist of any number of parts that will divide without remainders, by the different times in which the different persons are to perform the work, and proceed agreeably to the tenor of the question.

24 A and B together can build a boat in 20 days; with the assistance of C they can do it in 12; in what time would C do it by himself? *Ans.* 30 days.

25 A can do a piece of work alone in 13 days, and A and B together in 8 days; in what time can B do it alone?

Ans. 20 $\frac{4}{5}$ days.

26 A, B and C can complete a piece of work in 15 days, A can do it alone in 30 days, and B in 40; in what time can C do it by himself? *Ans.* 120 days.

27 In a certain orchard $\frac{1}{3}$ of the trees bear apples, $\frac{1}{4}$ pears, $\frac{2}{5}$ plums, 60 of them peaches, and 40 cherries; how many trees are in the orchard? *Ans.* 1200.

28 A person willing to distribute some money among a number of beggars, wanted 8d. to give them 3d. a piece; he therefore gave each 2d. and had 3d. left, how many beggars were there? *Ans.* 11.

29 A guardian paid his ward 3500*l.* for 2500*l.* which he had held in his possession 8 years; what rate of interest did he allow him? *Ans.* 5 per cent.

30 A stone measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches thick, how many solid feet doth it contain? *Ans.* 41 feet 3 inches.

31 A room 30 feet long, and 18 feet wide, is to be covered with painted cloth, how many yards of $\frac{3}{4}$ wide will cover it? *Ans.* 80 yards.

32 If I buy 100 yards of ribbon, at 6 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings, do I gain or lose, and how much?

Ans. lose 3s. 4d.

33 There is a mast or pole, $\frac{1}{3}$ of its length stands in the ground, 12 feet of it in the water, and $\frac{5}{8}$ of its length in the air, or above water; how much was the whole length?

Ans. 216 feet.

34 The hour and minute hands of a watch are exactly together at 12 o'clock, when are they next together?

The velocities of the two hands of a watch or clock, are to each other, as 12 to 1; therefore the difference of velocities is 12—1=11

$$\text{As } 11 : \left\{\begin{matrix}12\times1\\12\times2\end{matrix}\right\} :: 1 : \left\{\begin{matrix}1 & 5 & 27\frac{3}{11}\\2 & 10 & 54\frac{6}{11}\end{matrix}\right\} \text{ Ans. \&c.}$$

35 A person being asked the hour of the day, said the time past noon is equal to $\frac{4}{5}$ of the time till midnight; what was the time? *Ans.* 20 minutes past 5.

36 If the earth be 360 degrees in circumference, and each degree 69$\frac{1}{2}$ miles, how long would a man be in travelling round it, who advances 20 miles each day, reckoning 365$\frac{1}{4}$ days in a year? *Ans.* 3 years 155$\frac{1}{4}$ days.

37 At the close of the American war the British government owed 280,000,000*l.* and the pound sterling contains 3oz. 17dwt. 10gr. of silver; I demand the number of tons Avoirdupois, 7000 grains Troy being equal to one pound Avoirdupois; I likewise wish to know how long a string of waggons it would take to carry the whole, a ton at a load, and 3 rods apart? *Ans.* { wt. 33178T. 11cwt. 1qr. 20lb. / Distance 311 miles, 14 rods.

38 A and B traded together; A put in 320*l.* for 5 months, B 460*l.* for 3 months, and they gained 100*l.*; what was each man's share of the gain?

Ans. { A's share is 53*l.* 13s. 9d.+ / B's share is 46*l.* 6s. 2d.+

39 Shipped to Jamaica 550 pair of stockings, at 11s. 6d. per pair, and 460 yards of stuffs at 14d. per yard, in return for which I have received 46cwt. 3qrs. of sugar, at 24s. 6d. per cwt. and 1570 lb. of indigo, at 2s. 4d. per lb.; what remains due to me? Ans. 102*l.* 12s. 11$\frac{1}{2}$d.

40 The account of a certain school is as follows, viz. $\frac{1}{10}$ of of the boys learn geometry, $\frac{2}{5}$ learn grammar, $\frac{3}{10}$ learn arithmetic, $\frac{3}{20}$ learn to write, and 9 learn to read; what number is there of each? Ans. 5 learn geometry, 30 grammar, 24 arithmetic, 12 writing, and 9 reading.

41 A certain usurer lent out 90*l.* for 12 months, and received principal and interest 95*l.* 8s.; I demand at what rate per cent. he received interest. *Ans.* 6 per cent.

42 A stationer sold quills at 11s. per thousand, by which he cleared $\frac{1}{5}$ of the money; but growing scarce raised them to 13s. 6d. per thousand; what did he gain per cent from the prime cost by the latter price? *Ans.* 96*l.* 7s. $3\frac{3}{11}$d.

43 A man gave to his three sons all his estate in money, viz. to F half, wanting 50*l.* to G one third, and to H the rest, which was 10*l.* less than the share of G; I demand the sum given, and each man's part?

Ans. The sum given was 360*l.* whereof F had 130*l.* G 120*l.* and H 110*l.*

44 A gentleman divided his fortune among his three sons, giving A 9*l.* as often as B 5*l.* and to C but 3*l.* as often as B 7*l.* and yet C's dividend was 2584*l.*; what was the whole estate? *Ans.* 19466*l.* 2s. 8d.

45 What is the purchase of 1200*l.* bank stock, at $103\frac{5}{8}$ per cent.? *Ans.* 1243*l.* 10s.

46 What is the difference between six dozen dozen, and a half a dozen dozen? *Ans.* 792.

47 Three persons purchased together a ship, toward the payment of which A advanced $\frac{2}{9}$ and B $\frac{3}{7}$ of the value, and C 200*l.* how much paid A and B, and what part of the vessel had C? Ans. A $90\frac{10}{31}$*l.* B $116\frac{4}{31}$*l.* and C$\frac{3}{6}\frac{1}{3}$ part.

48 Laid out in a lot of muslin, 480*l.* 11s. upon examination of which, 2 parts in 7 proved damaged; so that I could make but 5s. 6d. a yard of the same, and by so doing, I lost 45*l.* 6s. by it; at what rate per ell english, am I to part with the undamaged muslin to make up said loss? Ans. 12s. $3\frac{3}{16}\frac{3}{0}$d.

49 What sum of money will produce as much interest in $3\frac{1}{4}$ years as $504 36cts. would in 5 years and 5 months?

Ans. $840 60cts.

50 Twenty knights, 30 merchants, 24 lawyers, and 24 citizens, spent at a dinner, 64*l.* which sum was divided among them in such a manner that 4 knights paid as much as 5 merchants; 10 merchants as much as 16 lawyers, and 8 lawyers as much as 12 citizens; the question is to know the sum of money paid by all the knights; also by the merchants, lawyers, and citizens?

Ans. 20 knights paid 20*l.* the 30 merchants 24*l.* the 24 lawyers 12*l.* and the 24 citizens 8*l.*

51 The yearly interest of Harriet's money, at 6 per cent. exceeds $\frac{1}{20}$ of the principal by an 100*l.* and she does not intend to marry any man who is not scholar enough to tell her fortune; pray what is it? Ans. 10000*l.*

52 What is the decimal of 3 qrs. 14 lb. of an cwt.?

Ans. .875

53 A brewer mixed 17 gallons of ale, at 8d. per gallon with 19 gallons at 10d. per gallon, and with 40 gallons at 6d. per gallon; what is 1 gallon of this mixture worth; and also the worth of the whole quantity?

Ans. { 0*l.* 0s. 7d. 1qr. $\frac{14}{76}$ per gallon.
{ 2*l.* 7s. 2d. price of the whole mixture.

54 A gentleman left his son a fortune; $\frac{4}{10}$ of which he spent in 3 months; $\frac{3}{4}$ of $\frac{5}{6}$ of the remainder lasted him 9 months longer, when he had only 537*l.* left; what did the father bequeath him? Ans. 2082*l.* 18s. $2\frac{8}{11}$d.

55 There are three horses, belonging to different men, employed to draw a load from Poughkeepsie to Hartford for 35 dollars, A and B are supposed to do $\frac{3}{7}$ of the work, A and C $\frac{5}{13}$ and B and C $\frac{4}{14}$ of it. They are paid proportional; please divide it for them as it should be.

Ans. { A $13 79+
{ B 6 45+
{ C 14 75+

56 A hare starts 12 rods before a hound; but is not perceived by him until she has been up 45 seconds; she scuds away at the rate of 10 miles an hour, and the dog on view, makes after, at the rate of 16 miles an hour: how long will the course hold, and what space will be run over, from the spot where the dog started?

Ans. { Distance 2288 feet.
{ Time $97\frac{1}{2}$ seconds.

FINIS.

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NEW GEOGRAPHY.

Just published and for sale at Potter's Bookstore, Poughkeepsie, (N. Y.) and at all the principal Bookstores in the United States,

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RECOMMENDATIONS OF THE WORK.

Mr. DANIEL H. BARNES, A. M. Principal of Dutchess County Academy, whose reputation as a public Teacher of Youth, stands as high as that of any man in the state, has politely communicated to us his opinion, in the following note—

Poughkeepsie, 2d June, 1814.

Mr. POTTER,

I have received a copy of your "*Easy Grammar of Geography,*" and in answer to the request therewith communicated, I am happy to inform you, that the book, as to its plan and arrangement, meets my *entire approbation.* The method of placing the *exercises* immediately after each principal division of the globe, and making them to include all the important facts previously laid down, appears to be admirably calculated to facilitate the rapid and correct progress of the students. The propriety of closing with astronomy is obvious. The maps are neatly executed, and being bound separately from the book, will be highly useful and convenient. I do not hesitate to say, that in my estimation, this compendium of Geography, is preferable as a first book, to any which I have seen. I shall adopt it immediately in my department, and recommend it to the associated masters in this institution. Yours respectfully,

D. H. BARNES.

Mr. Andrew Beers, from whom the following note has been received, is now engaged in the arduous and important undertaking of writing a Gazetteer of his native state, Connecticut, similar in plan to Spafford's.

DANBURY, 14th July, 1814.

Mr. Potter,

SIR—I have thoroughly examined Mr. Willetts' "*Easy Grammar of Geography*" with the accompanying Atlas, published by you; and I might with much propriety (if needful) enter into the particulars of its high merits and great utility: but suffice it to say, that I have been an old teacher, in the usual mode of Geography and Astronomy, and I am now constrained to say, that I regret the many days, months, and I may even say years, I have spent in teaching accord-

ing to the usual Books, only for the want of just such a one as you have hit upon. For young pupils it certainly exceeds any thing of the kind I ever saw. To study Geography and Astronomy without *Maps, Figures*, &c. is as absurd as to teach a child to call over the Alphabet without seeing the shape of the letters. The convenience of having the Atlas by itself is obvious, as it must be constantly used in search for an answer to every question, which I readily conceive will be a kind of pleasing labour to the scholar, and soon make him a proficient in Geography. Yours, &c.

ANDREW BEERS.

The following letter is from the author of the Gazetteer of the State of New-York.

Albany, 7th Mo. 4, 1814.

Esteemed Friend,

I have examined thy "EASY GRAMMAR OF GEOGRAPHY" and the 'ATLAS,' with some care. For an elementary book, in common schools, the plan meets my entire approbation; and so far as I have been able to observe, it is very well executed. Being a cheap and useful book, it ought to, and probably will, find its way into every school in the state. I had been long since solicited, by several persons employed in the instruction of youth, to write a work of this kind, on the same plan, and am very happy to see that my prospective labor may be dispensed with. Wishing thee very great success in thy literary enterprise, I remain thy friend,

HORATIO GATES SPAFFORD.

Paraclete Potter.

Mr. R. O. K. BENNETT, from whom the following letter has been received, is a teacher of the first standing and respectabilty, who has for many years been employed in the city of Albany.

ALBANY, June 24, 1814.

Dear Sir—Your "*Easy Grammar of Geography*," and accompanying Atlas, have been duly received. As an elementary book, it is justly entitled to a preference to any I have seen on the subject. It supplies what has long been wanting in common schools and academies, and what I have frequently heard called for—an easy epitome of Geography, at a moderate price, and on a plan calculated to exercise the ingenuity, as well as the memory of pupils. Thoroughly convinced of its utility, I shall lose no time in introducing it into my school; and shall be much rejoiced to find it soon in general use. The astonishing and truly gratifying changes which have taken place in the political aspect of Europe, will render it necessary for the compiler to make in a second edition (which I hope a discerning public will soon call for) some trifling alterations. Wishing you all the success to which the merits of this book justly entitle you, I remain,

Your obliged humble servant, R. O. K. BENNETT.

Mr. P. POTTER.

Mr. John Griscom, a Teacher of the first respectability in the city of New-York, has favored us with the following note.

I have examined an "Easy Grammar of Geography" prepared by Jacob Willetts, and do not hesitate to say, that the author, in my

opinion, has fully attained the object he had in view; viz. to improve the popular little work of Goldsmith, and especially to adapt it more completely to the youth of this country. Thus improved, I consider it as one of the best Geographical compends for the use of American Schools, which has yet been published.

JNO. GRISCOM.

New York, 7 mo. 9th, 1814.

The Rev. John Reed, A. M. Rector of Christ's Church, in the village of Poughkeepsie, has favored us with his opinion as follows—

"I have examined Mr. Willetts' "Easy Grammar of Geography," together with the Maps accompanying it, and think it decidedly the best compendium of Geography for common schools yet presented to the public."

The Rev. Cornelius C. Cuyler, A. M. Pastor of the Reformed Dutch Church, in Poughkeepsie, has politely furnished us with the following recommendation :—

Poughkeepsie, 2d June, 1814.

Dear Sir,

I have given your edition of Mr. Willets' "Easy Grammar of Geography, for the use of Schools," together with the small Atlas accompanying it, as careful a perusal as time and other avocations would permit, and feel a pleasure in informing you, that it appears to be well calculated to facilitate to the young student, the acquisition of Geographical knowledge—I should therefore feel pleased to see it introduced into our schools. One of its principal excellencies is, that it will necessarily oblige the student to exercise other faculties besides his memory.

I remain yours, &c.

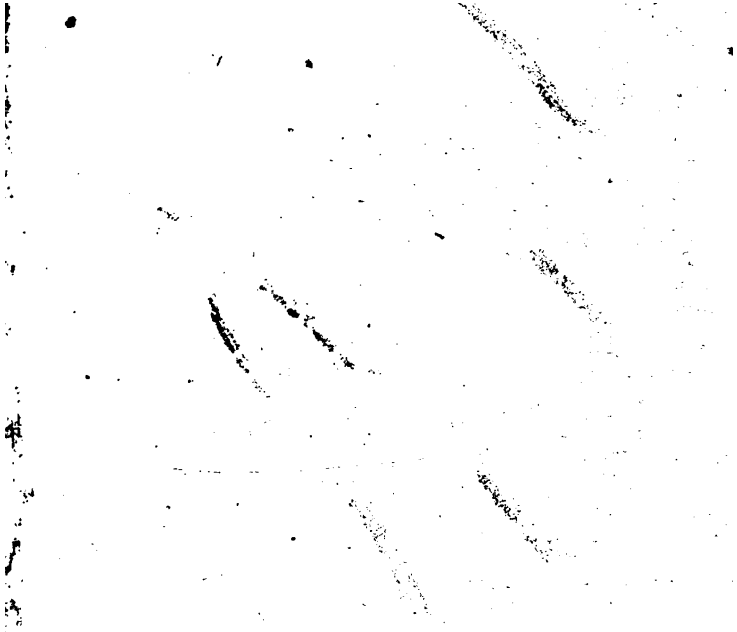
CORNELIUS C. CUYLER.

David Brooks, Esq. well known to the public as having filled for many years the office of first judge of Dutchess county, and who has at different times been a member of the legislature of this state and of the United States, has obligingly favored us with his opinion, as follows :—

Mr Potter—I have examined a small Tract, entitled "*An Easy Grammar of Geography, for the use of Schools,*" &c. with an Atlas of seven Maps, compiled by Jacob Willetts, and published by you; and am fully of opinion that it will be a very useful elementary book for beginners in Geography. The Maps, although upon a small scale, appear very accurate, and the lines *distinctly marked.* They afford a more correct idea of the *relative* situation of places, than those on a more extended scale; and being bound separate from the book, will be more durable and easy of inspection. I have no hesitation in recommending this book as a very useful *Compend;* and the moderate price at which it is afforded, puts it in the power of every scholar to procure it.

Wishing an extensive circulation to this useful little treatise, I remain, sir, your most obedient servant— D. BROOKS.

Poughkeepsie, June 1st, 1814.



Just published by P. POTTER, and for sale at his Bookstore in Poughkeepsie, and at the principal Bookstores in the United States ; A second and improved edition of

The Scholar's Arithmetic,

For the use of schools in the United States :—By Jacob Willetts, author of "*An Easy Grammar of Geography*," *&c.*

The following recommendation of the Scholar's Arithmetic has been politely furnished by the eminent and worthy President of Middlebury College, Vermont.

The subscriber has examined with attention "The Scholar's Arithmetic," compiled by Mr. Jacob Willetts, and is confident in the opinion, that the judicious arrangement of its parts, the manner of its execution, and the very moderate price of the book, justly entitle it to general patronage.

H. DAVIS, Pres. Mid. College.

Middlebury, 30th May, 1817.

125 : 112.5/35.00/28
250
1050
100
87½
12½
100 : 100 :: 12½
12
1250

Montée - Chapiteau

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